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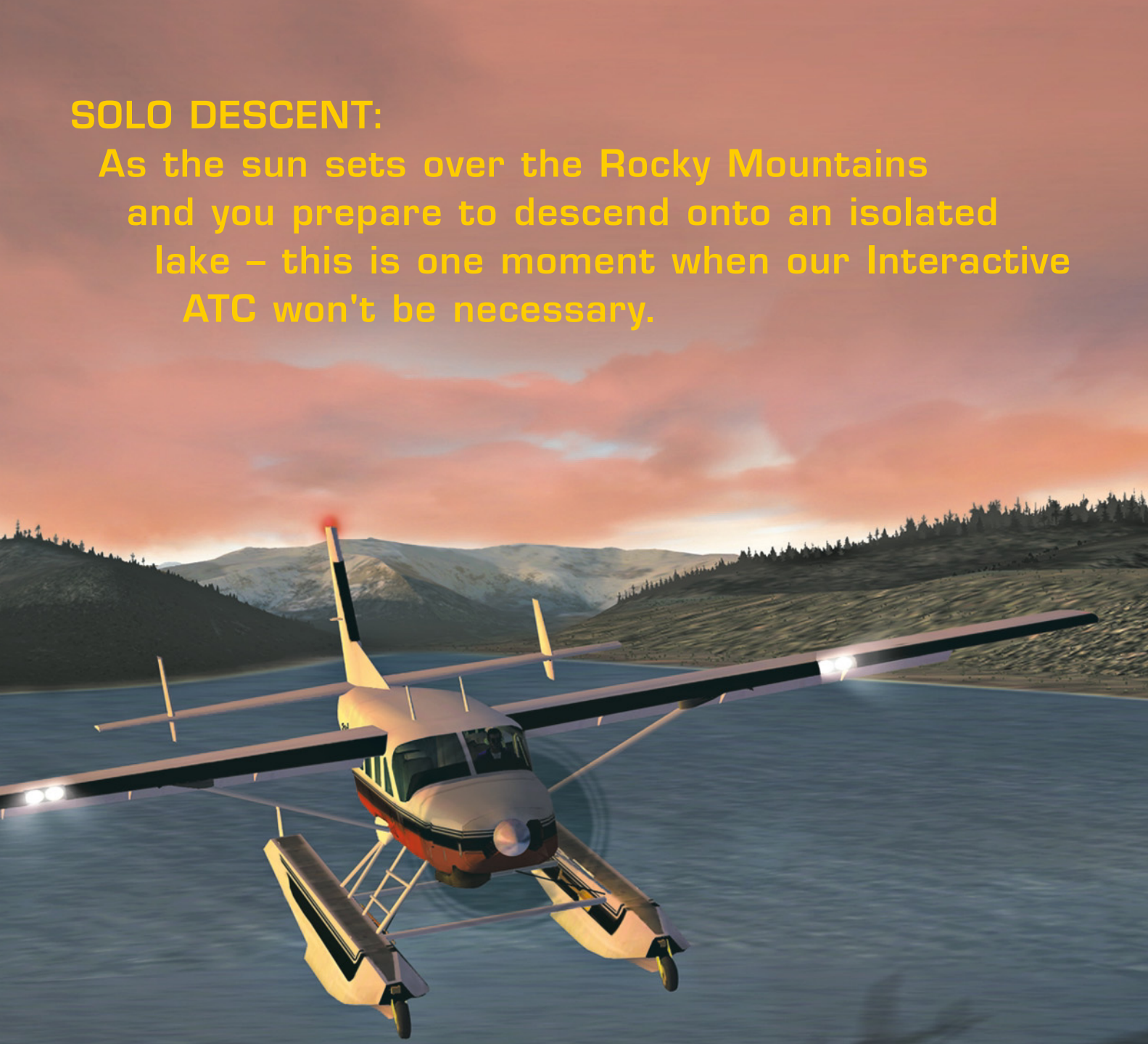

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PC PILOT

THE CREW

EDITORIAL

Managing Editor:
Dermot Stapleton (derm@pcpilot.net)
Assistant Editor:
Mark Embleton (mark@pcpilot.net)

Contributors:
Tim Parker, Stephen Heyworth, Bill Stack, Greg Gott, Christopher Jarman, Peter Wright, Joe Lavery, Len Hjalmarson, Brian Rubin, Derek Smalls, Joe M. Besser

Printed and Distributed by:
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FEEDBACK

PC Pilot Limited,
PO Box 11, St Ives PE27 3GW,
United Kingdom
Tel: +44 (0)870 900 0422
Fax: +44(0)1480 357186
Email: mail@pcpilot.net
Website: www.pcpilot.net

BUSINESS AND MANAGEMENT

Publishing Director:
Mungo Amyatt-Leir (mungo@pcpilot.net)

Commercial Director:
Andy Payne (andy@pcpilot.net)

Design and Layout by:
Fink Creative
Oliver Hilton, Richard Pomfret, James Lawrence & Darryl Fickling

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"Ground Control to Major Beavis"

Editor's letter

Future sims showcased

Palm trees sway in the breeze, the ocean laps against miles of golden beaches, and bronzed beauties lope across the sand, their surfboards tucked beneath their arms. No, it isn't the annual tram conductors' convention in Cleethorpes. This month we're in Los Angeles for the Electronic Entertainment Expo (or E3 for short), which is the games industry's yearly extravaganza to show off the software they hope we'll all become obsessed with over the next few months. It's a veritable parade of pixels, pundits and PR, but a peep beneath the surface reveals much that's of interest to flight simmers (or at least, that's what we told the accounts department).

Star of the show from an FS perspective was Combat Flight Simulator 3. The Microsoft stand was dominated by a huge Spitfire hung from the roof above a mocked-up aircraft fuselage. If nothing else, this clearly demonstrates Microsoft's commitment to the CFS series. Inside the aircraft a select few were given a demonstration of the delights that will be available when CFS3 comes out in the late autumn. There'll be 18 different aircraft types, constantly changing 'intelligent' campaigns, new scenery and all the latest graphics goodies to enhance the view. You'll also get the chance to fly bombers, become an air gunner or pilot a couple of early jets (a Vampire, Me262 and an F-80). They've even included a German 'flying wing' jet bomber that never made it past the drawing board. FS2002 meets Secret Weapons of the Luftwaffe? It looks like being well worth the money, and we noticed that one leading add-on developer was already making a few notes!

However, CFS3 wasn't the only sim around, and it was interesting to see that, after the games industry hastily announced the death of flight sims a couple of years ago, they have finally been proved wrong. G2 Interactive gave us the full lowdown on their plans for Falcon, the hugely popular jet combat sim that they acquired from Infogrames. A spruced-up version, called Falcon – Operation Infinite Resolve, designed to utilise the latest video cards, will be out in the autumn. They expect a completely new Falcon V (5.0?) to be released by the end of 2003.

On the Simon & Schuster stand Jay Littman and Colonel 'Wild Bill' Stealy showed us Warbirds III and the new Warbirds Korea (the title of the latter probably explains the subject matter). Together with Dawn of Aces they are hoping that these titles will confirm them as a market leader in the online flying arena.

Microsoft were giving CFS3 pride of place this year

Meanwhile, Strategy First took us for a sneak preview of Project One: Strike Fighters, and Strategy First is also busy developing a number of popular games, which suggests, by default, that flight sims are getting popular again.

It was heartening to see a number of jet combat games are being released for consoles. We may dismiss them as arcade-style toys, but if the big publishers are successful with flight sims in this competitive arena they will be more likely to spend a few pounds on developing better sims, which will benefit all of us in the long run.

So, it seems that there's plenty to look forward to for fans of combat simulation and the opportunity to do some flying from your PC should be available for a while yet. As the evening sun sinks below the waves at Santa Monica and the nightlife on the 'Strip' begins to kick into gear, PC Pilot's editor must wearily pick up another brandy Alexander and totter once more into the melée. Flight simulation certainly has its advantages when the big games publishers get involved!

Dermot Stapleton
Managing Editor

COMMS

mail@pcpilot.net

Downloads debated

Many thanks to all of you who wrote to let us know your opinions on freeware and downloads. The mail we received was almost unanimously appreciative of the skill and generosity of freeware authors, while many of you acknowledged that installing downloads can demand a little patience and perseverance. Here are some of your comments…

FROM: Jerry Olson

I read the comments in your COMMS section related to including the freeware downloads on your CD for each edition. I would first like to thank you for those files and secondly, encourage you to continue this practice. It is difficult as it is to find the time to sim, let alone browse through hundreds of files on websites looking for the best our hobby has to offer. I currently do not have a cable connection or ADSL, so with the larger files these days downloading can be a tedious task at best. By the way thanks to the many folks who contribute those great files. We may not always say thanks, but we do appreciate the effort.

FROM: Mark Hoare

I did not benefit from the cover CDs of earlier issues of PC Pilot and I found it frustrating surfing the download sections. However I had the motivation to learn how to use the Windows OS, WinZip etc. and now I have no problems with freeware downloads. I too use commercial add-on products like Garry Summons' UK scenery and big jets like the PIC767, PSS747 and so on, but I also really enjoy the freeware scene as well. There really is some great stuff out there. I spend almost as much time tinkering with Flight Simulator and freeware panels and soundsets as I do flying. For me it is an integral part of our great hobby.

FROM: Peter Markham

I am the first to admit my limitations in computer knowledge, but I was delighted to find flightsim.com and all the other websites with wonderful and incredibly beautiful aircraft just for the taking. Learning how to download is a small price to pay for all items that are available; it really doesn't take much learning and you have lots of backup to help you on the net.

FROM: Clive Drake

I appreciate that some people enjoy tinkering with FS, but I think many more hate it simply because they don't understand what they are doing, and the slightest innocent error usually ends unpleasantly. I suspect that, for every person who likes tinkering with files, there are many more who hate it and shun download libraries as a result. Perhaps we could have a 'Mechanics' version for free and the 'de Luxe' version for payment by the technophobes or those too lazy to do the work. Now, if you will excuse me, I will try to load the Sikorsky from this month's disc. Please disregard the cries of anguish and tantrums which will follow shortly.

FROM: Antony Gardener

It would appear a basic lack of computer knowledge is at fault. Making folders, and copying and downloading files are really mandatory skills required by those who own and use a computer at home. If this is too much to handle, then buy a games machine, not a computer. The extra knowledge required to use freeware aircraft and scenery is easily acquired. Paying for a product is not an absolute guarantee it will be trouble free, and support is more often miss than hit. The dedicated folks that produce freeware make many excellent products. I often feel humbled to use, for free, products that have obviously taken so much time and effort to produce. Freeware expands the simulation experience at a cost we can all afford, and with very little comparative effort on the user's part.

Many people wondered why full installation programs are generally omitted from freeware files. All the developers we asked said very much the same thing. Here's one of them to explain:

There is an increase amongst the freeware community of the use of Installers – mainly the 'Free use for Freeware' ones provided by ClickTeam and similar, but it is still a minority. The main drawback with free installers is that they are 'general purpose', and don`t help with useful things like locating the FS path for you, so you end up with the user having to browse to the correct location himself. This makes for little improvement over a simple Zip file. Basically, there is nothing available for free use that can make a useful FS install without some extra programming knowledge. Even commercial alternatives (such as InstallShield)aren't a great improvement. It still takes a certain amount of programming knowledge to make something effective.

Finally, raise your glasses to the creators of this month's Star Download, a lovely Stearman biplane – complete with an installation program!

A beautiful plane with its own installation program. What more could you want?

FROM: Frank Allen

The excellent article in the May/June edition gave a useful introduction to floatplane flying. An excellent addition to FS2002 is the 'Waterland' freeware produced by Bob Tremblay, and the additions by Jeridan Light. It provides much better wake effects, which are more suited to each individual aircraft than the one standard effect. The four files you need can all be found at www.fsfreeware.com – landupd.zip, waterfx.zip, waterlan.zip, and waterup2.zip.

FROM: Patrick Warner

You pointed out that the floatplane in FS2002 is not fully realistic. One thing you did not mention is the unrealistic taxiing performance. Try parking the floatplane on a lake, setting the wind to very high strength, then go make a cup of tea or whatever. When you come back the floatplane will not have moved one centimetre. I don't think this is very realistic, and it's contrary to the MS Manual which says you can 'sail' the floatplane by pointing it into the wind and lowering the flaps (I have tried this with no success).

Furthermore, if you switch on the engine, the floatplane still doesn't move at all. Surely it would move forward even at idle throttle in reality? It won't move until you throttle up to about 30% throttle and then it suddenly starts accelerating. Perhaps the water in FS2002 is not really water but tar or treacle?

In any case, for a better floatplane taxiing performance I recommend Flight Unlimited III – I don't know if it's fully realistic but it certainly 'feels' much more real compared to FS2002.

We reply:

Thanks for the tip (and the screenshot), Frank. We're happy to pass it on. It seems that we're not the only ones to have found the floatplane in FS2002 rather disappointing, and we've received several similar e-mails and letters on this subject – many of which mentioned Flight Unlimited III. We'll be taking a look back at the FU series in our next issue, but in the meantime we welcome any further suggestions for improving floatplane performance.

FROM: Sydney Beauchamp

Here we have a confusing subject. There is OpenGL, DirectX, Smart Shader, Smoothvision, Hyper ZII and other technologies built into cards. The question is, which card is BEST for FS2002? In my quest for better graphics and performance I want to upgrade the graphics card but do not wish to waste the cash if it would not make any improvement.

Greg Gott replies:

A potentially dangerous question to attempt an answer to! Flamers are waiting behind rock and tree, armed and ready should one choose sides... so, I will take the role of a Taoist. There is not, never has been, and most likely never will be, a definitive video card for flight simulation. Only the now deceased 3dfx has ever considered flight sim software during the development of a video chip (the VGA-100), and we were blessed with a superb product – the Voodoo 5. Furthermore, the question of money is always a consideration.

Having said that and assuming money is no obstacle, at this point in time the nVidia GeForce4 4600 is the most progressive video chip in the world for 3D gaming. For what it costs, is it better/faster in FS than the ATI Radeon 8500? That is strictly a subjective matter, and brings us to a frustrating conclusion: the qualities of video cards, like beauty itself, reside in the eyes of the beholder. Tip: Visit the forums at FlightSim.com, AVSIM Online and the simFlight Network for opinions and insights into graphic cards.

FROM: Doug Ward

I joined the hordes of subscribers to PC Pilot as far back as Issue 11, and at that time was a closet Top Gun F-16 fighter pilot. It's obvious that the software we use is only half responsible for the sheer pleasure we get from spending many hours flying the simulated skies. There must be others who believe there is more to FS than sitting your PC on a desktop. In my plane the [A] key has been removed from the keyboard and, if anybody tries to operate the autopilot using the mouse, they will be unknowingly blasted into the ceiling of my garage by a rocket pack stowed under the seat. OK! they won't really, but don't tell my father-in-law.

Boys never grow up; their toys just get that little bit more expensive!

We reply:

Who said all FS fans take their hobby too seriously?

PC-CDROM

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This exciting add-on from the author of the award winning freeware program S-Combo takes flight simulation to a totally new flight-level of realism, by adding incredible audio enhancements to your virtual world. FlightDeck Companion (FDC) works with Microsoft Flight Simulator 2002, 2000 and 98.

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  (Note: Interactive features are not available when using FS98)
- Many flight deck calls based on aircraft type, weight and speed
- Hear the Captain making flap and gear calls at the correct time
- A Virtual copilot to operate gear and flaps
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- Add additional aircraft support using the FDC performance editor
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- Flight log facilities
- Blackbox log facilities
- Totally new, easy to use, interface for working with the hundreds of available options
- A printed Quick Start guide is supplied plus a 250 page electronic manual on CD

REVIEWS

"The added ambiance and interactive element makes the simulation experience even more *As real as it gets!*" - Aidan Williams **(AVSIM)**

"FDC is just what flight simmers have been craving for and is a leap forward in pursuit of that continually elusive 'realism' factor." Eoin Sutton **(FSPlanet)**

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NEWS

FlightSims.co.uk

Unfortunately our friends at FlightSims.co.uk (www.flightsims.co.uk) have recently suffered at the hands of hackers, and have been forced to rebuild their downloads centre. This may have caused visitors a few problems, but we're glad to say that they are now up and running again, so drop by and see what's available.

Double Trouble

Following on from the success of Sabre vs. MiG, US development studio Flight One have brought out another famous pair of dogfight doubles for CFS2. This time they set up the P-51 Mustang against the Focke Wulf Fw190. Combat fans will be able to recreate the high-speed confrontations that took place over Europe when the Mustangs defended their bombers against German fighters. Just Flight are soon to publish a boxed version for Europe at £19.99, and from what we've seen so far, you can expect the usual superb Flight One aircraft, plus missions and authentic scenery.

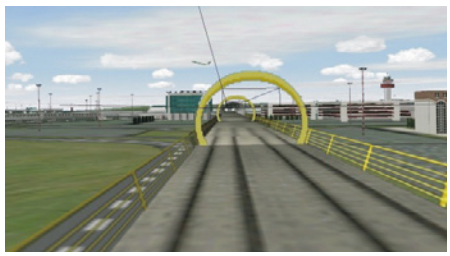
It's all go at Lago

Lago (www.lagoonline.com) have a couple of interesting projects due for release this summer. Emma Field is an airport add-on with a difference; it's actually a simulation of the sights, sounds and activities that you might expect at a small local airfield, from glider club meetings to weekend barbeques in the summer. Everything happening on the airfield will be dependent on the time of day and the current season. FSSoundScape is expected to do for audio enhancements what FS Scenery Enhancer did for the visual aspects of an airport; you'll be able to add sounds (either those included in the package or any of your own) to locations in FS2002, as well as the situations in which you want them automatically replayed.

REAL GAUGES FROM THE REAL COCKPIT

The Real Cockpit team from The Netherlands have recently launched their range of replica cockpit instruments for FS2002. Something of a Holy Grail for cockpit builders, these are actual instruments, rather than software, which run from FS2002 on your PC, and operate through servo motors and electronics. Around 30 devices are available, from IFR instruments to switches and controls. We'll be taking a closer look at some of them in the next issue, but for now have a look at TRC Development's website: www.therealcockpit.com.

WORLD AIRPORTS



The Simflyers scenery development team are soon to release their first boxed product. Many of us are familiar with their download offerings but now their latest airport scenery, specifically designed for FS2002, will be published by Just Flight and titled World Airports. There'll be nine of the world's busiest airports featured, six in Europe and three in the US. The level of detail is amazing, even down to individual road signs outside the airports! Release is set for the summer and PC Pilot is already barging to the front of the check-in queue.

STRIKE FIGHTERS: PROJECT 1

It looks very much like Christmas will be arriving early this year for combat fans. Not only have we got Lock On and CFS3 to look forward to, but now Texas-based Third Wire Productions has announced that their Strike Fighters: Project 1 jet combat sim, developed by the designer of European Air War, will be released worldwide this summer. We're promised seat-of-the-pants combat action in a range of jets, including the McDonnell F-4 Phantom, Lockheed's F-104 Starfighter, the Douglas A-4 Skyhawk, and the F-100 Super Sabre.

The dynamic fictional campaign spans the whole of the 60s, and accurately follows advances made in aviation and weapons technology over the decade. Start with the basic F-100 Super Sabre and work your way up to the F-4, with its deadlier capabilities – and deadlier opponents. In addition to Instant Action and Single Mission sorties, you'll be able to fly as an airborne mercenary, using the payments received for your services to maintain and improve your aircraft and its abilities.

Of particular interest is the announcement that new aircraft, missions and campaigns will continue to be produced after release, and that add-on developments will be welcomed – essential these days to ensure the longevity and evolution of any new sim. A new graphics engine will be used, employing the latest DirectX technology, and bold claims have been made about the level of graphic detail, texturing and lighting effects. Take a look at www.thirdwire.com for more screenshots and the full story.

SHOWTIME!

The summer's on its way, thankfully, so it's time to put a few dates in your diary for some of the legendary airshows around the country. Duxford, worth a trip on any day of the year, has some themed spectaculars lined up: the Flying Legends Air Show on 14 July (the premier warbirds show in Europe), We'll Meet Again on 7-8 September, marking the 60th anniversary of the US 8th Air Force's arrival on these shores, and the Autumn Air Show on 13 October, focusing on spies and spy planes. See the website at www.iwm.org.uk/duxford/index.htm or call 01223 835000 for full details.

The Farnborough International Airshow (www.farnborough.com) will be held on the

weekend of 27-28 July, and the 40th Biggin Hill International Air Fair (www.airdisplaysint.co.uk) will be taking place on 2 and 3 June. The second day of the show is on a Monday, which is a Bank Holiday in commemoration of the Queen's Golden Jubilee.

FS RADIO SHOW

If you've got an Internet connection, you might want to turn off your ATC and tune into FssaRadio. Ian Gerada and Ian Rattray of Flightsim.co.za host a live weekly broadcast, lasting at least an hour, covering all things flight sim-related. Both fanatical flight simmers, they broadcast the show from Fort Lauderdale, Florida every Sunday at 8pm UK time (1500 hours Eastern Standard Time in the US), although they usually get started a few minutes beforehand to activate the link.

You'll need Windows Media Player (v7.xx or above), and if you haven't already got it,

you can download it for nothing from www.microsoft.com. Tuning in is quite simple; just go to www.flightsim.co.za and click on the LIVE SHOW link at the correct time. Alternatively, click on the File menu in Media Player, click on Open URL, and type in http://fssaradio.flightsim.co.za:8080. During the show you'll be able to send in your questions and comments to fssaradio@flightsim.co.za.

THE FORCE IS BACK WITH US!

LucasArts Entertainment Company recently announced the resumption of its relationship with Lawrence Holland and his company Totally Games to develop a WWII combat sim for next-generation consoles and PCs. Previous associations between LucasArts and Totally Games produced the best-selling X-wing and TIE fighter series of Star Wars games, as well as Secret Weapons of the Luftwaffe and Their Finest Hour: The Battle of Britain. The latter two games are to serve as inspiration for the new air combat title. It's expected to be released in 2003, and promises to immerse would-be fighter aces in dynamic battle scenarios in a variety of combat theatres over Europe and beyond. The story-driven game will drop players into a secret, elite squad of pilots who undertake

the most dangerous missions of World War II. Sounds interesting, and if it's as good as Their Finest Hour was in its day, then it'll be well worth a spin.

Global Traffic Manager

Control freaks who'd like to take charge of the AI aircraft in FS2002 might be interested in a program currently in development by Indesign. Global Traffic Manager's user interface will let you design, create and alter AI traffic all over the world, and interested parties are invited to e-mail their suggestions to requests@indesign.plus.com, with 'AI Traffic Manager Requests' in the subject field.

IL-2 expansion coming soon

The legions of IL-2 Sturmovik fans will be delighted to hear Ubi Soft's latest announcement. 1C:Maddox Games, the developers of the already legendary combat sim, will be releasing two new maps for IL-2. The Forgotten Battles, as the expansion will be titled, will include maps for both Finland and Hungary, and will feature over twenty new missions and several new flyable and AI aircraft – Russian, German and British – possibly including aircraft modelled by third party developers. It looks very much like the best is going to get even better.

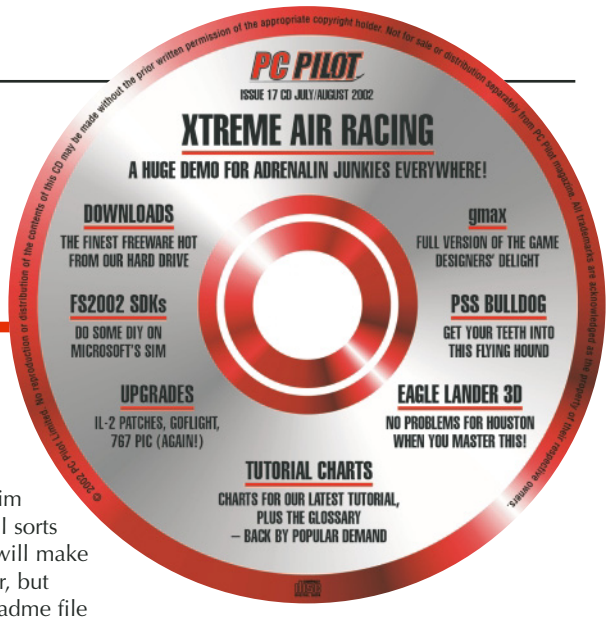
Century of War Competition

Congratulations to all our winners, who each get themselves a Corgi model collection and a copy of Just Flight's Combat Aces or Battle of Britain Memorial Flight. The winners were Wulstan Fairclough, D. Ditcher, Terry Gladwell, A. McNeill, R. Hollinworth, Eric Pennington, Jeremy Stevens, Mark Bewick, G. Smith and Phil Hamilton. We hope you'll enjoy them.

Comanche 4 Competition

The lucky winners of our Comanche 4 competition, all of whom should be keeping busy with a selection of goodies from NovaLogic are John Haxby, Gagandeep Singh Bhogal, Benjamin Aston, Rudolf Stravens, Stephen Price, Patrick Wadsworth, Ian Hoyle, Simon Harper, Andrew Oyston, Jason Davies, Tino Broekstra (Netherlands), Reynold Bowen, Keith Darbyshire, A. Frener, M. Allott, Ivo Fantuzzi (Switzerland), Mark Cleminson and Ernie Laycock.

COVER CD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ISSUE 17 CD JULY/AUGUST 2002
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TUTORIAL CHARTS
CHARTS FOR OUR LATEST TUTORIAL, PLUS THE GLOSSARY – BACK BY POPULAR DEMAND

GETTING STARTED

To get the CD running, close all programs and applications and place the PC Pilot CD in your CD-ROM drive. If Autorun is enabled, the program will start and you will see the opening screen and menu buttons. If you don't have Autorun activated, or the CD doesn't start automatically, press the 'Start' button on your Windows taskbar, move up to 'Run' and left click on it. Type in the 'Open' window: D:/issue_17 (where 'D' is the drive letter of your CD-ROM drive), then press OK and the menu should appear. If all else fails, go to 'My Computer', right click on the CD icon and select 'Explore'. You should then be able to open up the folders as required.

XTREME AIR RACING MEGA-DEMO

Here's a full-blown chance to fly this amazingly accurate simulation of the world's most exciting sport. To get racing, either click the button on the main CD menu or navigate the CD to the XAR folder and click on the 'setup' icon. Once the demo is loaded it may try to run at once and give you an error message. This is because its graphics engine is defaulting to 3dfx. To get rolling, just close down the program and click on your Windows Start icon. Then select Programs and click on Victory Simulations (not Victory Interactive)

and run the game from here by selecting the OpenGL mode and the appropriate screen resolution. Slightly complicated, but this is because the demo is designed around an earlier version. The published version will automatically detect graphics settings and it's well worth persevering – this really is adrenalin-fuelled flight!

IL-2 STURMOVIK PATCHES

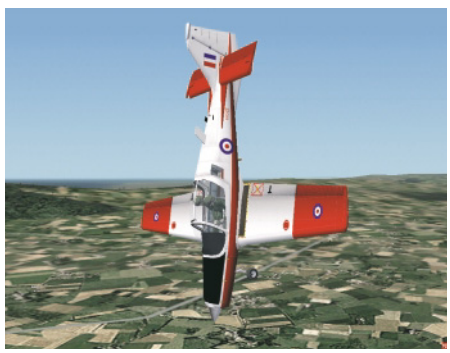
By popular demand… here are the latest updates for the best combat sim around at the moment. There are all sorts of improvements and goodies that will make your Eastern Front flying even better, but please make sure you digest the Readme file before attempting to install anything!

767 PILOT IN COMMAND

Many of you, and us included, made the mistake of following the link on Wilco's site to the 'new' patch for 767 PIC, only to find that you had downloaded the old one for FS2000. The patch we put on the last CD was the old one, but we've now included the CORRECT patch for FS2002. Our apologies if you were confused, but you're in good company! For full details on how to install, check out www.wilcopub.com

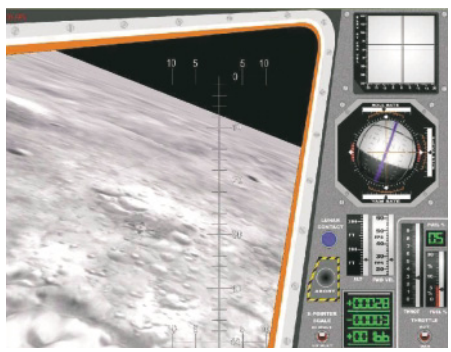
PSS BULLDOG

In the last issue we took a look at a rather excellent BAe Bulldog that Phoenix Simulation Software were offering free to customers who registered at their website. We really enjoyed chucking this little beauty around the sky, and now PSS have kindly given their permission for us to put it on our CD. There's a comprehensive manual included in Word to help you get the best out of it. Happy looping!



EAGLE LANDER 3D

This amazing creation by Ron Monsen (www.wright-flyer.net/desertaviation) is a simulation of the final minutes of the Apollo 11 moon landing. It begins as the automatic landing sequence stops and manual flight control begins. During the actual Apollo 11 landing Neil Armstrong switched to manual control of the LM (lunar module) to avoid a rocky area near West Crater and landed further downrange. In Eagle Lander 3D you must do the same; you can attempt a 'historical' landing near the original Eagle landing site or you can second guess Armstrong and choose a different location. Eagle Lander 3D is designed to realistically render the physics and dynamics of the LM as well as the terrain of the lunar surface.



FS2002 SDK

No, SDK isn't a European left-of-centre political party, it stands for Software Development Kit, and a number of parts have been released by Microsoft for FS2002. To save readers the bother of downloading, we've included the latest eight parts of the kit on the cover CD. To find out more about the kits, check out: http://zone.msn.com/flightsim/FS02DevDeskSDK00.asp

THE gmax TREATMENT

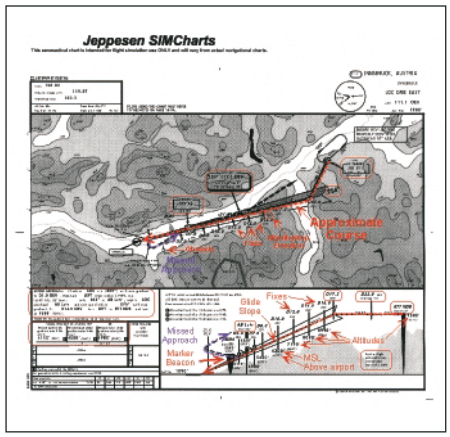
Since the release of FS2002, Kinetix has upgraded and extended the features of the free version of gmax and it's no longer possible to register the FS2002 version online. The folks at Kinetix, however, have kindly allowed us to put the new gmax, including tutorials, on the PC Pilot CD. Elsewhere in this issue you'll find Peter Wright's excellent tutorial on getting started with gmax. Don't go deleting the gmax directory you've already got in FS2002 just yet, though – the Game Packs that let gmax work with FS2002 are in there, and they'll be needed in setting up the new version.

GOFLIGHT

If you've discovered the joys of flying using GoFlight's excellent cockpit hardware products, you'll be pleased to see the latest software update for the GF-AFC control system on the CD. Also, if you own a GF45 and want to get it working with Fly!II, we've included a great freeware utility from Luis Balarin to do just that. For full details of their product range check out www.goflightinc.com

CHARTS

The charts for our latest tutorial are included on the CD in easy-to-use PDF format. If you have any trouble accessing the charts, go to 'My Computer', right click on the CD icon and select 'Explore'. You can then open the folders as required. Many of you have written to us asking for information on how to understand the various symbols used on Jeppesen charts. Back in the dim and distant mists of time (Issues 3 and 4, actually) we compiled a complete glossary for Jeppesen charts and we've included it as a PDF file in the charts folder. To view this, or the Jeppesen charts used for our tutorials, you'll need Acrobat Reader, which is also included on the CD.



VIRTUAL AIRLINES

We've put the latest list of VAs on the CD, and also included a small description of each one to help distinguish between all these great online airlines.

WINZIP & ACROBAT READER

You'll need these important utilities to open up Zip files or read PDF files. Please note that any shareware should be paid for and registered if you want to use it on a regular basis.

IMPORTANT - TECHNICAL SUPPORT

The CD and software on it are free and as such, neither PC Pilot, nor any of the publishers or developers of the software supplied on the CD can provide technical support. The software is supplied very much 'as is' and without support. Enjoy the CD and the software on it!

The Best Gaming Graphics EVER. Guaranteed.
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PRODUCTS
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You Won't Believe Your Eyes...
Immerse yourself in a world of stunning, holographic 3-D visuals. All the latest games plus graphics, movies, websites and more come alive with our revolutionary new E-D™ technology. Slip on our glasses and instantly transform your PC into your very own virtual reality simulator, capable of producing an "IMAX-like" experience that, until now, has only been achievable at theme parks or with expensive equipment. Step inside your PC and go beyond the confinements of your monitor...
From £69.95 Inc
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£249.95 inc.
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Unit 6, 306 Industrial Estate,
2-244 Broomhill Road, Brislington, BRISTOL, BS4 5RG,
Telephone: 0117 971 5000 Facsimile: 0117 977 4720
Email - sales@rcsimulations.com
Go Flight Controls

Visual Flight Real VFR

(So new it hasn't yet been officially named...)

UK scenery revolution

You may recall that in the last issue we reviewed the UK & Ireland scenery from Visual Flight, which was a great improvement on the default FS2002 scenery. Well, it looks as though they've got another product up their sleeves that is set to blow away the current terrain texturing techniques.

It utilises a totally new method of mapping actual photographic data onto an accurate terrain mesh that covers the whole of the UK; this means that the roads, fields, villages and other landscape features that you see are exactly where they should be. The implication of this for VFR pilots is significant because, as good as FS2002 is, you can't really use it for true VFR flying. There's no doubt that Microsoft's FS series improves with each new revision and that many of the major landmarks are now depicted, but the vast majority of the landscape is still made up from generic tiles that don't bear any real resemblance to the actual area they represent. Ultimately, any serious flight planning or pilot training is impractical.

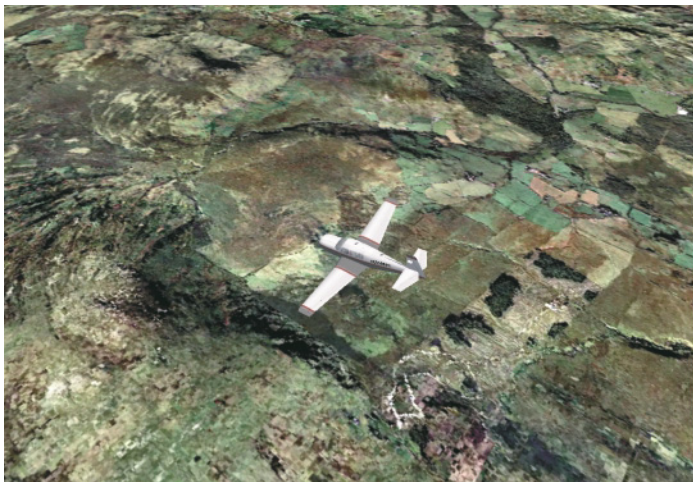
I'm sure that many of you will take issue with the last statement, but when you are being taught to fly VFR, the instructor will constantly require you to verify your position using large buildings or any other unusual landscape features; in FS2002 these items simply don't exist, but they would be if the terrain over which you're flying had been created from a series of seamless interlocking aerial photographs.

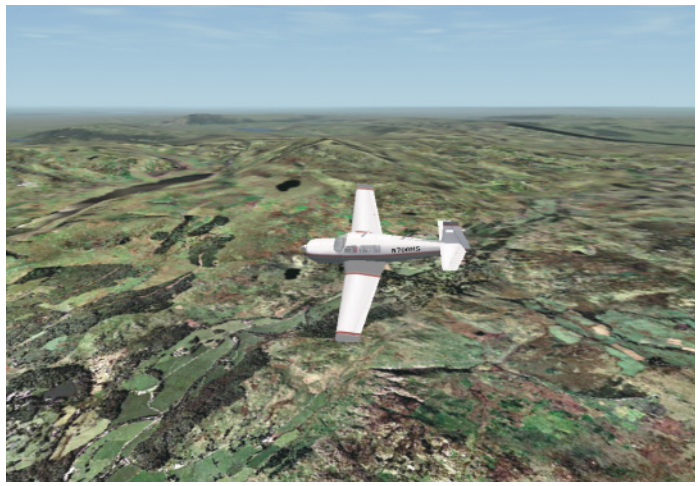
Visual Flight's ground-breaking new product (which has yet to be given an official title) is the brainchild of John Farrie, and uses photographic data supplied by Getmapping plc, established in 1998 with the specific aim of producing the Millennium Map – the very first complete aerial image of the UK. The co-founders, Tristram Cary and Joe Studholme, began the photographic work in 1999; they used a process of geo-correction, from Ordnance Survey Land Line Base data, to remove any artefacts created by camera distortion or altitude variations, and to make the photography fit conventional line mapping. This produces an extraordinarily detailed scenery image.

The new scenery packs will initially be sold by regional area across England and Wales, with elevated terrain data to match. The ultimate goal is to have ultra-high resolution data covering the areas around major cities and airports, so that during your descent the scenery will retain its definition. Because this product is still in the development stage, John is toying with other ideas for the future, one of which is to map the photographic data over buildings created from terrain mesh. The advantage of this is that there would be no break in the texture, and so the buildings wouldn't look as though they had been superimposed. It would also mean that airports would blend in much better with their surroundings, which they certainly don't at the moment. There are very few real airports that can be seen clearly from 30 miles away; in fact it's sometimes difficult to spot many of them from a distance of just five miles.

It's also worth mentioning that the screenshots which accompany this article were taken while flying over demonstration areas supplied by the author, and they don't really do justice to the product. In the same way that stopping a videotape and taking a snapshot produces an undefined picture which is rather out of focus, putting a flight simulator into Pause mode and grabbing a screenshot seems to create edges and contrasts that are not apparent in the moving image. We're also told that the final product will be created using higher resolution images than those shown here,

Follow a line feature as easily as in real VFR flying





Has the Lake District ever looked better?

so the detail level should be even higher and allow you to fly at lower altitudes without any loss of definition.

John supplied us with a number of different areas to explore, but obviously the one that interested me the most was around my home airfield of Cardiff. It was quite amazing, because I immediately started to recognise landmarks and familiar territory over which I'd flown many times before. As you can see, I took one screenshot with the aircraft directly over my own home. John told us that this is one exercise that everyone who's seen the scenery wants to repeat, usually dragging friends and family in to have a look as well!

Surprisingly, the frame rate is not affected at all by the new scenery. Like any texture-mapped images the scenery looks best viewed from 2,500-AGL feet or above, although, as we said before, the final product will use higher-resolution source images to generate the scenery. It goes without saying that the FS fraternity are always looking for products that will increase the realism of their simulated flights, and Visual Flight's new scenery promises to be a giant step forward, providing a new incentive for everyone to potter around in light aircraft simply to sightsee and explore their own neck of the woods – with the facility to spot their own home as well. We look forward with anticipation to the final release, which surely represents a quantum leap in scenery development.

Joe Lavery

Preview Information

Publisher: Visual Flight

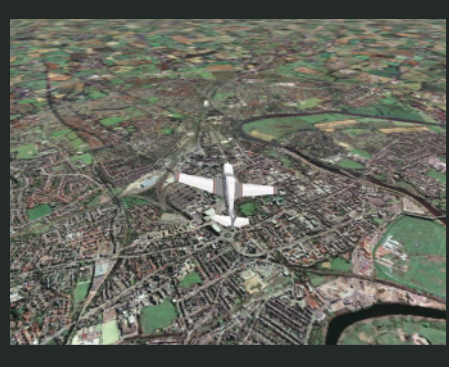
Price: TBC

Website: www.visualflight.co.uk & www.getmapping.com

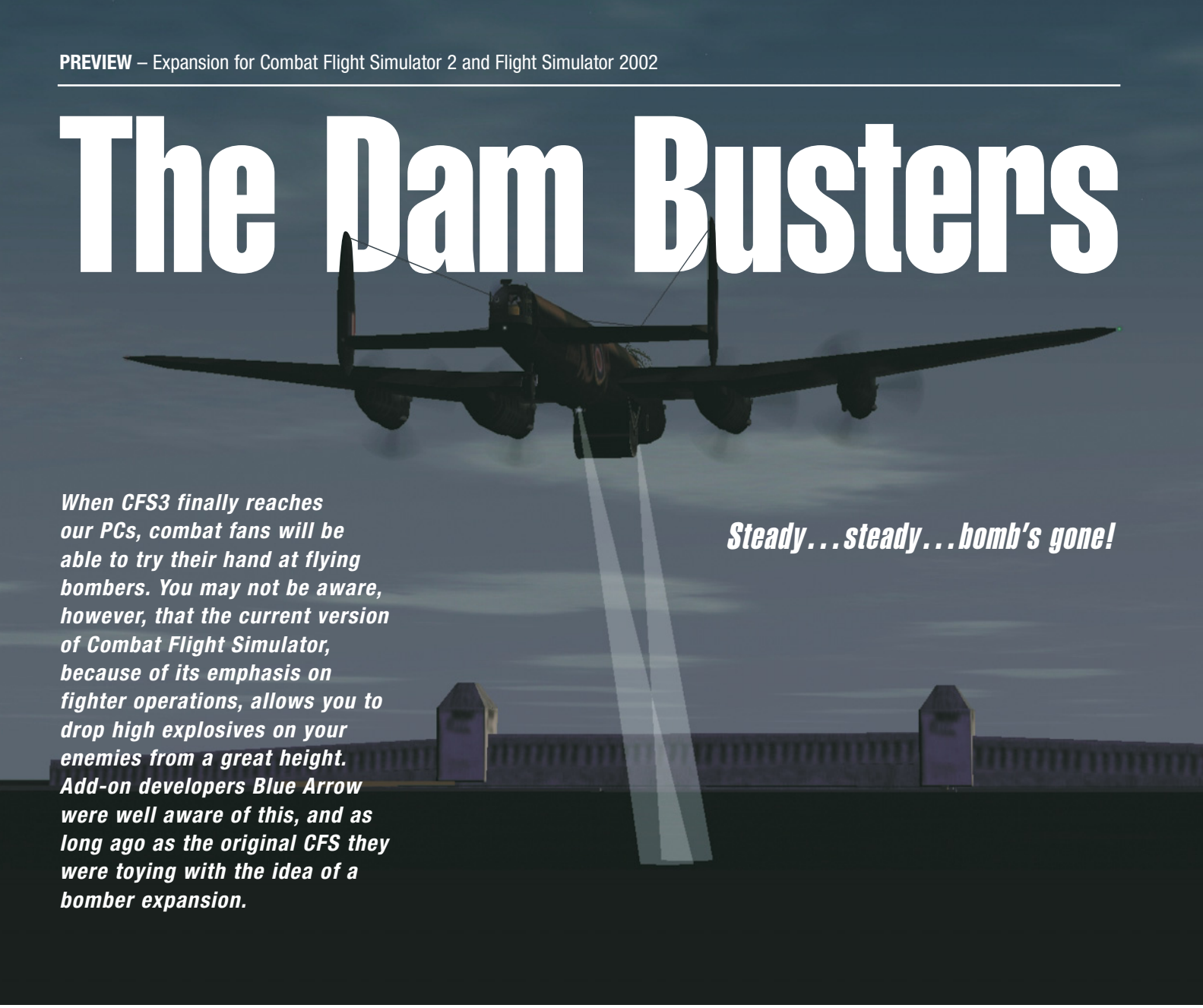
Developers: John Farrie and Getmapping plc

Expected Release Date: Summer 2002

VFR flying in Cheshire with Visual Flight



The Dam Busters



When CFS3 finally reaches our PCs, combat fans will be able to try their hand at flying bombers. You may not be aware, however, that the current version of Combat Flight Simulator, because of its emphasis on fighter operations, allows you to drop high explosives on your enemies from a great height. Add-on developers Blue Arrow were well aware of this, and as long ago as the original CFS they were toying with the idea of a bomber expansion.

Steady…steady…bomb's gone!

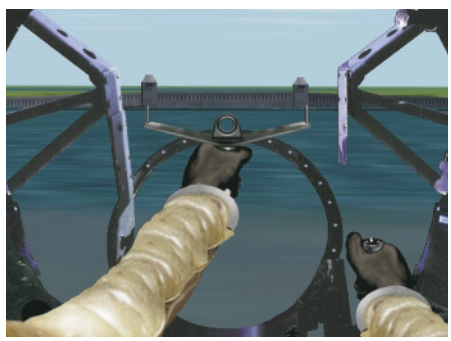
Their various ideas finally coalesced into a very ambitious plan – to recreate one of the most famous bombing raids of WWII: Operation CHASTISE, or The Dam Busters raid, when Lancasters from the specially formed 617 Squadron attacked and breached two of the three huge dams that held back millions of gallons of water from the Ruhr valley in Germany. For good measure, they also decided to include some of the other great raids carried out by 617, including attacks on battleships and dropping some of the largest bombs this side of Hiroshima.

The 617 Squadron crest – their motto translates as "After me the flood"

The fact that one of the greatest inventors of the 20th century, Barnes Wallis, had struggled with the science of bombing the dams from the air didn't put them off, and it won't be long before The Dam Busters comes to a PC near you.

"O for orange…we're going round again…"

Just Flight's software will contain three different Lancasters – a standard B.1, one adapted to take the 'bouncing bomb' (or Upkeep mine, to give its official name), and the third as the Grand Slam-carrying aircraft capable of taking an enormous bomb halfway across Europe. There will also be a Mosquito (as a pathfinder) and a Vickers Wellington that was used for the initial testing of the Upkeep mine. Authentic airfields and scenery of the Mohne, Eder and Sorpe dams will also be included. There will



We wouldn't have believed it possible – a bomb aimer with the real 'sight' that was used by 617!

The Grand Slam takes off – without a bomb aimer. He'll come to his post once they're airborne

Sailor beware!

A Grand Slam-equipped Lancaster over RAF Scampton. Ten tons of trouble!

even be flight plans so that FS2002 users can visit the scenery areas and do some sightseeing. The dams raid will form part of a 20-mission campaign in CFS2 that will chronicle the exploits of 617 Squadron.

The software we've seen so far is truly amazing. From the custom bombsight (the real thing was two nails hammered into a Y-shaped piece of wood) to the searchlights used to pinpoint the exact height of the aircraft over the water, Dam Busters really looks the part. There are battleships to attack as well as other famous targets and, if you think you're a skilled pilot, you'll have to put your money where your mouth is when you try to get your Lancaster down to 60 feet through a hail of flak in order to drop your Upkeep.

You can see from the early screenshots that this expansion is going to be something different. This will certainly join the list of amazing expansions, including Combat Aces and Harrier Jump Jet, which allow the user to get far more from Combat Flight Simulator than you would believe possible. The enemy coast is ahead, the Merlins are roaring, and it's definitely a case of 'maximum effort' from Blue Arrow and Just Flight. ■

Derek Smalls

Preview Information

Publisher: Just Flight
Price: £24.99
Website: www.justflight.com
Developer: Blue Arrow
Expected Release Date: Summer 2002

Separating fact from fiction

The real raid on the Ruhr dams has been the subject of a famous film and has also generated a huge amount of discussion, much of it ill-informed. Here are a few facts about the raid that you might find interesting:

Sir Arthur 'Bomber' Harris, the head of Bomber Command, was not, as has often been stated, against the idea. Initially he felt that removing 30 new Lancasters and crack crews from frontline operations was a waste of resources. Once he had met with Barnes Wallis, he was convinced of the chances of success and gave the operation his full support.

The bomb was not shaped like a huge bowling ball. This myth came about after the release of the very popular 1954 film starring Richard Todd. Footage of Lancasters had the 'bomb' added afterwards, and the rudimentary special effects made it look like a ball. It was in fact a huge cylinder, similar in shape to an oil drum, that was driven by chain and sprocket (like a bicycle wheel) to spin backwards at a precise speed (about 500rpm) so that it was revolving when it hit the water. It would then hit the wall of the dam and wind itself downwards close to the wall before exploding at a pre-arranged depth.

The bomb itself didn't actually cause any damage to the dams; it was designed to create an underwater earthquake and the shock wave of water was responsible for fracturing the concrete wall of the structure.

The raid wasn't a failure. If nothing else it was a huge propaganda success and is still part of popular culture 60 years later. It's true that, had the Sorpe Dam been breached as well as the Mohne and the Eder, the result would have been even more devastating. Albert Speer, the German Minister for Armaments Production admitted after the war, "What was the harm to us was the water for the coking plants for gas, which was a key to our industrial processes in the Ruhr, and water for the cooling processes in steel and other industries. We needed a lot of water and the Ruhr wells could not possibly supply enough. It was a disaster for us."

Sir Barnes Wallis – the genius behind the Upkeep mine

Sir Arthur Harris – initially sceptical, he later supported Wallis

Albert Speer with Hitler – he acknowledged the success of Operation CHASTISE

Vietnam Air War – Tour of Duty

No checklists for Charlie!

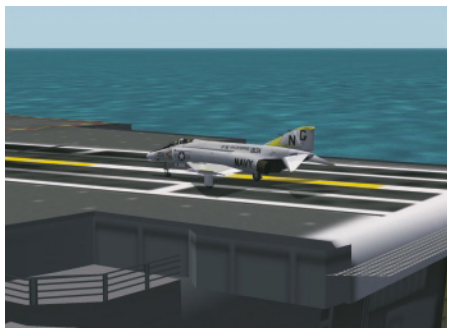
We've seen standalone combat simulations and add-ons for every theatre of war, from the Western Front in WWI, to the Falklands, the Pacific in WWII, the Korean War, the Battle of Britain and even fictitious future Cold War scenarios in Rage's Eurofighter Typhoon. One period, however, that's been noticeably absent is the late 1960s and early 1970s, when America (ably assisted by Australia, which many people forget) was engaged in a bitter conflict with North Vietnam, attempting to prevent another part of the world (South Vietnam) from sheltering beneath an ever-widening Communist umbrella.

The politics have been well documented over the years and it would be far too simplistic (and not entirely correct) to say that America lost the war. Protest against Vietnam is as much a cliché of the 1960s as free love and hippies, and the war is still a sensitive subject across the Atlantic (and probably in South-East Asia as well). Numerous films have now been released about the war and so recreating the aerial conflict for flight simulation is unlikely to ruffle any feathers. As long as it's accurate…

Coming in fast on the radar is Vietnam Air War – Tour of Duty from Just Flight. It should serve to fill this gap in the history of air combat, and will add to the already huge range of expansions that take CFS2 air warfare from 1914 to 2002. We must admit that, when we first heard the details of Vietnam Air War, we were a little surprised that this would form the subject for an add-on; to the average European lay-person, the Vietnam conflict was partly famous for its lack of aerial combat. Most of the flying, we thought, was pretty one-sided and involved bombing huge swathes of jungle. However, a little research and a perusal of the product specs revealed otherwise.

Vietnam Air War will contain 10 flyable US aircraft (five Air Force, five Navy) and three NVA MiGs (two MiG-17s and a MiG-21).

Ho, Ho, Ho Chi Minh – We shall fight and we shall win!



It may be the Enterprise, but no jokes about Captain Kirk, please!

Easily the most recognisable member of the US contingent will be a superbly modelled Bell UH-1C helicopter, or Huey as it's better known. The Phantom is naturally included, as well as some less common types such as the F-8 Crusader. There'll be six new AI aircraft (including a B-52 and an RAAF Canberra, ships (you can actually land on the Enterprise), scenery and two airbases. The most interesting part of the package looks to be the set of thirty missions that form part of three different campaigns – one USAF, one USN and one NVAF.

Looks like they've been up all night polishing the fuselage

Amongst the missions we've seen so far are some highly realistic sorties in the various aircraft, such as bombing SAM-7 bases and attacking on the Ho Chi Minh Trail, but surely the most ambitious for a CFS2 add-on is the challenge to rescue wounded soldiers in the Huey. This must be a first for CFS2, and if they can pull this one off then the developers deserve a Silver Star! We've had a spin in some of the aircraft and they appear very well detailed. The scenery will make use of GSL (Global Scenery Layer) technology – another first for an add-on. All things considered, this looks like it will be a very different package, and one that CFS2 users are bound to find exciting. As we say over here, "I love the smell of Twinings English Breakfast Tea in the morning!" ■

Derek Smalls

The Huey – a welcome sight for a wounded soldier

Looks are deceptive – the Skyhawk was a bomber!

Preview Information

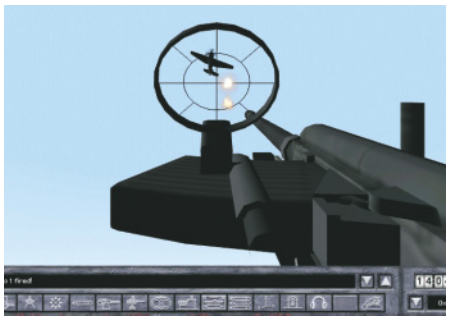
Publisher: Just Flight
Price: £24.99
Website: www.justflight.com
Developers: Various
Expected Release Date: June 2002

Silent Hunter II

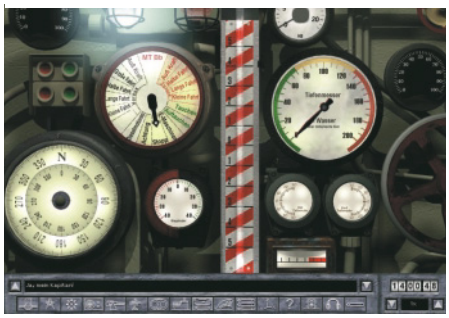
Swapping clear blue skies for the deep blue sea

The software box was passed gingerly around the PC Pilot offices, while everyone looked hard for a picture of a pilot, an airport diagram – or anything that might signify that it was aviation-related. Eventually, reasoning that a submarine could well be looked at as a large underwater plane without any wings, the software was loaded into one of our review PCs.

Less than twenty minutes later we had joined the Kriegsmarine and were chasing British merchant ships across the North Atlantic – Silent Hunter II is certainly intriguing. It's a WWII U-boat simulator, and its basic layout and structure will be familiar to any desktop flyer. Select a mission, a sub, adjust a wide range of parameters, and go hunting. But it's not quite as simple as that…



Get a different perspective on aerial attacks



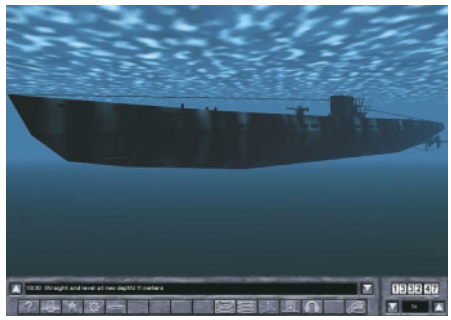
Helm controls look simple, but you'll be kept busy elsewhere

You need to click with a mouse to move from one station in the craft to another and, with all the major stations modelled, there's plenty to keep up with; the correct procedures just for aiming and firing a torpedo, for example, are considerably more complex than simply squeezing a trigger. Dealing simultaneously with torpedoes, the helm controls and gauges, different views, guns, radio messages, radar and the plot screen can be quite a strain, especially during missions where you're part of a hunting pack and have to keep on top of all the radio messages generated; the training missions are essential to avoid frustration.

The graphics are excellent, more so inside the sub than externally, but engaging combat in a submarine is an intense and claustrophobic experience, especially for those of us used to taking leisurely sightseeing flights around the virtual world. The video clips of ex-U-boat commander Erich Topp describing life aboard a U-boat provide a chilling insight into the realities of submarine warfare.

The missions and campaign are interesting enough to keep your attention, and numerous classes of ship and submarine are involved in the combat arena; there are actually plenty of aircraft involved, including torpedo carriers

The UZO station on the bridge shows a magnified view of your target



Beware underwater – it's easy to run aground

Another sucess for the Kriegsmarine

such as the Fairey Swordfish, Ju88 and Grumman TBF Avenger; you can't climb into any of the cockpits, unfortunately, but you'll get a taste of aerial attacks from a completely different perspective, particularly if you're manning the AA guns.

Silent Hunter II is unlikely to have you consigning your flight sims to the attic, but those who like to take an occasional peek beyond the boundaries of the FS world might well enjoy it. And there's not a train in sight!

Joe M. Besser

Review Score

Publisher: SSI/Ubi Soft

Price: £29.99

Website: www.silenthunterii.com

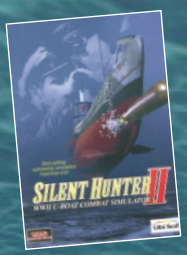
Developer: Ultimation Inc.

At a glance: An involving and entertaining simulator. The heat of battle can be heart-stoppingly intense.

System Requirements: PII 266MHz, 64Mb RAM, DirectX 8 or later, 16Mb 3D graphics card

Recommended: PII 600MHz+, 128Mb RAM, 32Mb 3D graphics card

Competition



Ubi Soft have kindly given us 20 copies of Silent Hunter II to give away, all of which are guaranteed to be free of traces of sea water and engine oil. Just answer these two simple questions to win a glimpse of life under the waves.

1) U-boat is derived from the German Unterseeboot, meaning:

a) Torpedo carrier

b) Underwater boat

c) The silent killer

2) The Fairey Swordfish was nicknamed the:

a) Stringbag

b) String Vest

c) Fighting Fish

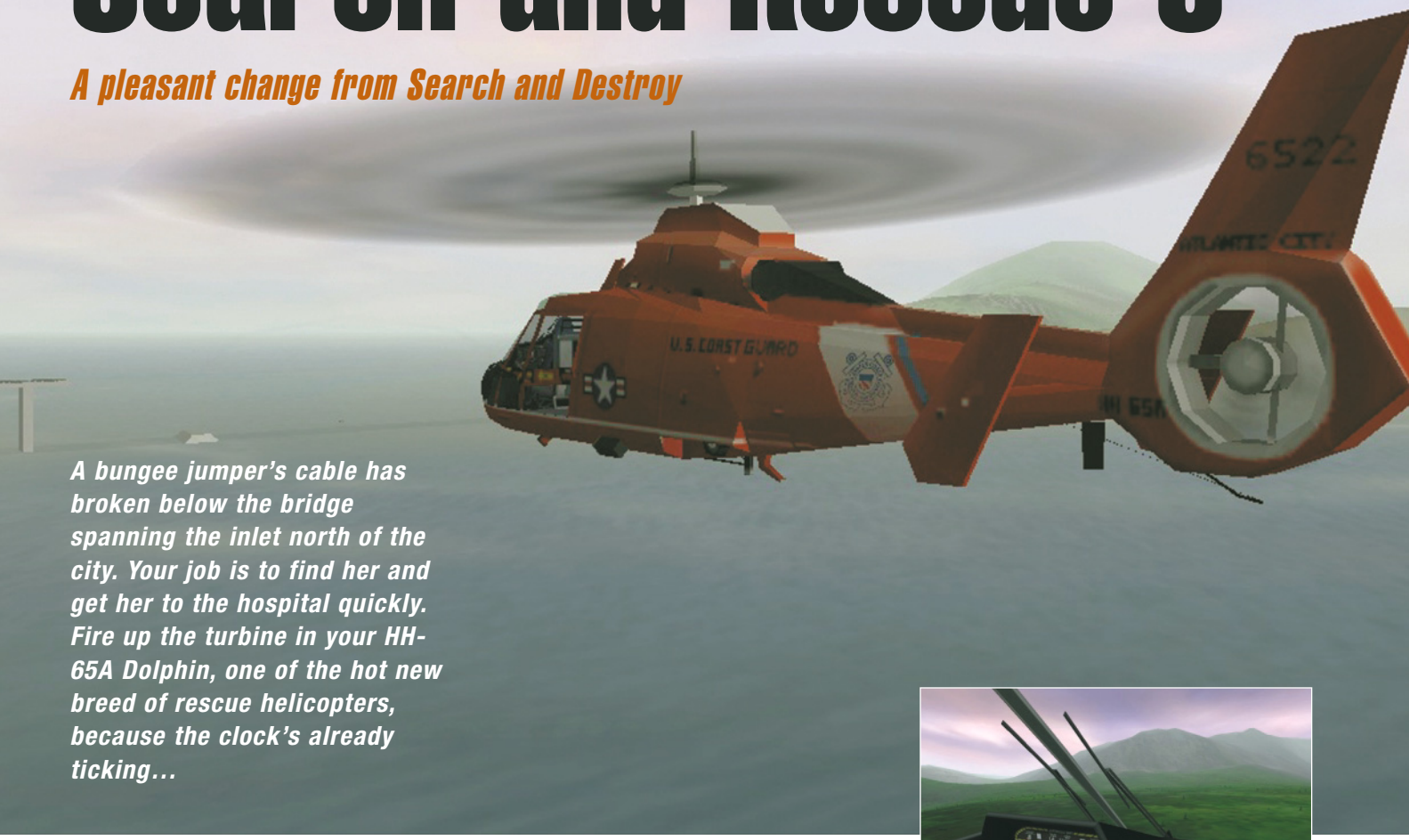
The competition is open to PC Pilot readers from anywhere in the world, with the exception of PC Pilot and Ubi Soft staff.
Send your answers by e-mail to comps@pcpilot.net or on a postcard or the back of an envelope to:

Silent Hunter II Competition
PC Pilot
PO Box 11
St. Ives
PE27 3GW, UK

Please make sure that you clearly state your full name, address and e-mail address (if you have one). The competition closes on 30th June 2002. Entries received after that date cannot be included, and prizes will be drawn at random from correct answers.

Search and Rescue 3

A pleasant change from Search and Destroy



A bungee jumper's cable has broken below the bridge spanning the inlet north of the city. Your job is to find her and get her to the hospital quickly. Fire up the turbine in your HH-65A Dolphin, one of the hot new breed of rescue helicopters, because the clock's already ticking…

Search and Rescue 3 won't take up too much of the precious space on your hard drive; it's around 65Mb in size, and the patch released to address some minor issues is only 500Kb. The manual included with the CD runs to 62 pages, and covers in some detail the various features of the helicopters and the rescue procedures you'll be using on your expeditions to save life and limb.

Prior to take-off we set our graphics and control options, and set screen resolution at 1024x768 and 32-bit colour. Oddly, the next time we set off to rescue the unlucky or foolhardy we had to set the resolution again. We had a worrying moment during controller configuration when we feared that our Thrustmaster Cougar throttle had not been recognised, but after trying various axes this was remedied with no problems. SAR3 also allowed us to invert the axis so that arcing the throttle away from us increased the collective. No matter what we did, however, we couldn't get our View hat switch recognised; apparently this is true of other joystick hats also. Eventually we programmed the View keys to hat positions and this worked fine.

SAR3 models three helicopters: the BK-117 C-1, the HH-65A Dolphin, and the Sikorsky SH-3 Sea King – a good selection which offers some variety in terms of flight characteristics, not to mention carrying capacity. We particularly liked the streamlined modern look of the Dolphin.

Cockpits are adequate, if a little dated

It's a lot tougher when the seas are rough!

Steady! Watch the handling when you've got a casualty on board

Inflight maps provide all the necessary details

Make sure you do your training before arriving at the rescue scene

SAR3 offers a detailed physics model; it's not up to X-Plane standards, certainly, but is quite sufficient to let you know you're not on a fair-weather sightseeing trip. The weather and adjacent objects will all affect the handling of your chopper and can catch out the unwary. Lowering a crewman into the air on a long rope and then moving from hover to horizontal motion is entertaining. Baskets, ropes and divers all add weight and inertia, and watching them bob about below you gives a genuine sense of involvement. Furthermore, divers swim towards their target, and crewmen lowered to the ground stride off to do their job.

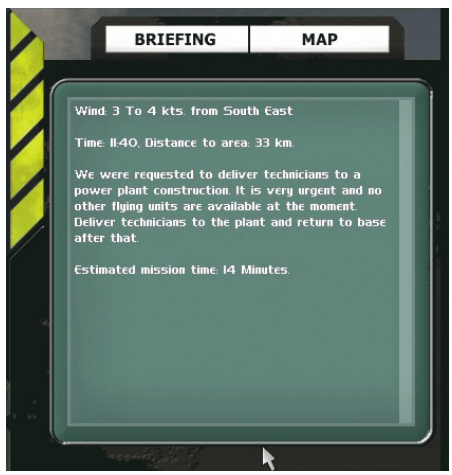
We usually flew with the Realistic flying option; feelings of inertia and torque were good, as were the stall effects, but there were times when the helicopter felt much as if it was suspended on a string. Some fairly advanced effects are included, such as retreating blade stalls and ground effect, which make it much easier to slow your descent and maintain a low-level hover over water or terra firma. Flying in Easy mode

The legendary Sea King in action

You'll have seen better graphics

takes care of all the complicated physics elements that make helicopters a challenge, but the simple stop/go flying will no doubt be too simple for many. The other option, Arcade, falls between the two levels of difficulty; you'll have to make control inputs, but will be able to focus more on the mission than on flying.

Using a combination of the simulated AFCS (Automatic Flight Control System), hover augmentation and autopilot means that the choppers are easy to manage if flown with care. The critical factors are not exceeding safe speeds, avoiding over-torque, and avoiding rotor contact with solid objects. Since the helicopters can be flown with


BRIEFING
MAP
Wind: 3 To 4 kts. from South East
Time: 11:40. Distance to area: 33 km.
We were requested to deliver technicians to a power plant construction. It is very urgent and no other flying units are available at the moment. Deliver technicians to the plant and return to base after that.
Estimated mission time: 14 Minutes.

One of the easier missions!

Fly with a panel…

…or a full screen

autopilot engaged (including turning), the pilot only has to achieve the general altitude and direction required and can let the flight computer worry about other details.

At the heart of SAR3 is the assortment of rescue assignments, which you'll be called on to perform under a wide variety of weather conditions in one of ten possible landscapes – water, forests, deserts, cities and so on. You might find yourself having to pick up an injured driver, rescue a mountain climber, deliver technicians to a nuclear power station, and plenty more besides. The varied nature of search and rescue operations allows a huge variety of scenarios, and so boredom and a sense of overfamiliarity aren't likely to be immediate concerns.

The campaign offers the substantial total of 100 missions. You take on the role of both the pilot and the flight mechanic, and are responsible for the safe and orderly conduct of the flight as well as the deployment of crew at the action scene. This means that not only do you deliver the crew to the correct location in time to save the day, but you also interact with them as they leave the helicopter. The pilot opens the cabin door in order for the hoist procedures to begin and, once hover is initiated, must change virtual hats to act as flight mechanic and deploy baskets or stretchers, or lower crew or divers from a rope and then haul them up with their grateful casualty.

While you can select the weather conditions in the single missions, the campaign is designed to increase in difficulty as you gain in proficiency, and this means that weather conditions tend to deteriorate the longer you fly, and you just have to cope with whatever weather is thrown at you. Urban incidents aren't necessarily going to happen in bad weather, but problems at sea usually will. Try hovering in a 40-knot wind to lower a diver and you'll appreciate just how tough it can get. Successful missions will result in promotion, based on the US Coast Guard's own ranking system. We were sent out in a variety of weather conditions, including rain, snow and ground fog, and flying in the dark or at dusk in bad weather can by very challenging; you can at least direct your searchlight exactly where you want it.

The realism of activities at the rescue scene is enhanced by some detailed communications between the crew, pilot and flight mechanic. You're in charge, so it's up to you to make sure the crew members are doing what's required of them. Simply opening the hatch initiates a sequence of four verbal exchanges. After a casualty has been rescued, you switch back to flying the helicopter and the flight mechanic provides ongoing updates on the patient's condition. You know you really have to race for home when your rescue subject is critical! The quality of sampling and voices is good; there's a pleasing degree of interaction, and the difference in volume between voices, engine noise and other effects is also nicely balanced.

Completing rescue operations can be tricky. It's sometimes difficult to tell where to land, and delivering technicians to a power station forced us to land and take off a number of times before the technicians would leave the chopper. At other times the precise location didn't seem to matter, but the basket's contact with the ground didn't seem to always register. On one occasion, when we could not lower the basket, we discovered we had forgotten to move the hoist out from the chopper with the [H] key. Victims in water were difficult to locate, as they undoubtedly are in the real world; if only we were prompted by a helpful crew member. If your winchman is reluctant to leave the safety of the chopper, you're probably too far from the casualty.

The package includes a set of training missions, which is always an excellent idea; they are helpful for learning the ropes, especially if you refer to the appropriate section in the manual while working through them. Six essential rescue procedures are detailed in step-by-step format in the manual, and it's a good idea to familiarise yourself with them before you arrive at the scene of an emergency.

Two features reduce the confusion you might initially experience. Firstly, there's a message

Finding a lone casualty among the waves can be tricky

On screen assistance comes in useful

Clearly not ideal racing weather

console on the lower section of the screen that covers the ADI until you hit the [Tab] key. Messages in the console will help you get to grips with your procedural errors. Secondly, hitting the [O] key brings up the Help screen, which offers step-by-step general assistance. When we flew our initial missions, we were puzzled about navigation; it's actually very simple, thanks to the modeling of the HSVD (Horizontal Situation Video Display) in the lower left of the panel.

The cockpit itself is adequate, and we tended to divide our flying time between the internal cockpit view, and the external chase view. Both views have an instrument overlay, and the pilot can access the critical cluster at any time with the [I] key. A variety of camera views – hoist, overhead, circling, and fly-by – let you keep tabs on the action, and you can zoom in and out at will if you need a closer look. The panel can be removed from the screen completely or made transparent with the correct keystroke.

Many owners of Search and Rescue 2 might have been hoping for a more substantial upgrade, particularly in the graphics department. We got the distinct feeling that the graphics engine is showing its age – graphics are often blocky, and can be let down by noticeable tearing of textures on the screen. The virtual world is not seamless, but is actually broken down into a series of square map areas; this is to ensure a high level of detail at ground level so that you'll have excellent fixed reference points during hover and rescue operations. Besides, if you're doing your job properly, you won't have time to enjoy the scenery. With the rescue scene often existing on a separate map, your flight can be interrupted by a 'time jump' to get you from one map to the next; some will doubtless find this annoying, while others will welcome the shortened flight time.

Objects are well modelled on the whole, but curved ones tend to be blocky, and the variety of terrain on offer is good. While the sky looks great and its colours can be vivid, it always has the appearance of a backdrop rather than the multi-dimensional clouds we've become used to in today's state-of-the-art sims. The collision bubble seems large, and twice while hovering near buildings we suddenly experienced a collision. In both cases we thought that the distance should have been adequate.

Every hour or so we experienced a system lock-up. We wondered whether this was related to the current nVidia Detonator driver, but we haven't experienced similar problems in FS2002 or IL-2 Sturmovik with the same driver revision.

While Search and Rescue 3 is an improvement over its predecessor, the series is due for a major overhaul. A new terrain engine is needed, as well as new dynamic and lighting effects. The cockpits look rather dated, and those used to FS2002 might be expecting more AI interaction. But then again, piloting a rescue helicopter is a lonely job. Overall, SAR3 is an enjoyable simulation which is genuinely fun to fly, and flying with instruments only in poor conditions is made possible by virtue of the instruments supplied. System requirements are sufficiently modest that those of us without the latest technology in our PCs won't have to shell out for an upgrade before taking off.

It's a long way, therefore, from being the definitive chopper sim that a lot of people are eagerly awaiting, but on its own terms it offers enormous variety in scenarios which no one else has simulated, and the unpredictability of events is sure to keep you interested. War-weary Comanche 4 veterans will at least have a rewarding peacetime career option waiting for them. It's just a shame that no European distributor has yet been finalised, but hopefully that will be remedied shortly. ■

Leonard Hjalmarson

Review Score

Publisher: Global Star Software (North America)

Price: £34.99

Website: http://pc.iavgames.com/sar3

Developer: InterActive Vision Games

At a glance: Three helicopters, 100 different missions, six types of terrain and all types of weather. SAR3 is a good upgrade from SAR2, but the graphics are looking dated.

System Requirements: Pentium 233MHz, 32Mb RAM, 16Mb 3D graphics card, DirectX 5

Recommended: PIII 500MHz, 128Mb RAM, 32Mb 3D graphics card, DirectX8

Just Flight

Celebrating 50 years of Jet Travel
1952 2002

Having stamped their authority on the world of flight simulation, Just Flight decided to team up with the Royal Mail and celebrate another famous 50th Jubilee for 2002. It was on 2nd May 1952, in the same year that Her Majesty Queen Elizabeth II ascended the throne to start her glorious fifty-year reign, that the de Havilland DH.106 Comet entered service with BOAC. To celebrate this momentous event, Just Flight has commissioned a limited edition First Day Cover, signed by Air Chief Marshal Sir Peter Squire GCB DFC AFC ADC DSc FRAeS RAF Chief of the Air Staff, Royal Air Force that features the five commemorative stamps which make up the Royal Mail series devoted to jet travel.

This is a strictly limited edition and only 250 of these unique first day covers will be produced. We are pleased to be able to offer them to our loyal customers through our newly updated website www.justflight.com or by personal allocation via phone, post or e-mail to the address below.

Priced at only £19.99 (including postage in UK) each of these covers represents an outstanding opportunity for any enthusiast to own a slice of aviation history. We recommend early applications to avoid disappointment!

Just Flight
www.justflight.com
Units A2/A3 Edison Road, St.Ives,
Cambridgeshire PE27 3LD United Kingdom
Telephone: +44 (0)1480 462748
Fax: +44 (0)1480 463070
mail@justflight.com

FlightDeck Companion

Virtual teamwork

The first few captaincies in a commercial pilot's career are often the hardest; unless a pilot is lucky enough to win sponsorship from a large airline, he's likely to start his career flying air taxi operations or night cargo transport. This is not significantly harder than flying the more exotic routes, but these operations are usually flown with a single crew member. Scaling the aviation career ladder not only brings bigger planes, but also an extra pair of hands to the cockpit. Having someone beside you to help out and check that you have done everything correctly will dramatically reduce the stress levels in the cockpit and effectively halve your workload. As its name suggests, OnCourse Software's FlightDeck Companion provides just this kind of assistance.

The package provides you with a very helpful first officer or co-pilot who will bring along the proper checklist and read it out loud for you. When he reads each item, the captain's voice responds to say whether the item is set as it should be. If it is not – perhaps, for example, you forgot to set the yaw damper at the appropriate time – you get a chance to correct your mistake, recheck the item and continue with the checklist. Your first officer will also make useful calls throughout your flight, such as "Rotate" and "Localiser active". Even better, you can delegate some tasks, such as handling the flaps and undercarriage, to your co-pilot.

This brings us to the next key attribute of FDC – just about everything can be configured. The default settings for each plane are pretty good, but you can tweak them to your heart's content to suit your particular style or favourite aircraft. Don't think that there are just a few checks available to you; there are dozens. If you were to switch them all on, you would have about 132 pre-start checks to complete, although some of these, such as circuit breakers, are for effect only. Despite this complexity, there are some checks that don't appear – checking the left and right magnetos, for example, carburettor heat, rpm drop, and pre-take-off power checks; these are vital checks for most piston-engined aircraft, so their absence is surprising.

To further customise the program to your particular tastes, you can also configure other features – the voices used, at what bank angle you want your co-pilot to issue a warning, the length of time after releasing the brakes before the first officer

Possible checklist configurations are endless

starts the taxi checks, whether the checklists start automatically or are triggered by a key press… The list is an extensive one. Because you are able to configure so much within FDC, the sheer number of parameters means that it may take you some time to get everything exactly how you want it.

The audio checklists cover all the stages of your flight, if you want to use them:

- Pre-start
- Before pushback
- Before start
- After start
- Taxi
- Before take-off
- After take-off
- Climb
- Descent
- Approach
- After landing
- Parking

If you decide that you don't want any of these, you can simply turn them off. You wouldn't, for example, need pushback checks for your Cessna 172. A useful feature of the FDC is ControllerX, which expands the capabilities of your joystick by allowing

A clear interface for initial setup

you to assign the buttons to different functions during these different phases of a flight.

The flight log feature of the program keeps a record of your flights, and a black box recorder can be used to check what FDC was doing during the flight. 'Ambiance' is also available to provide background sounds for your simulation. These are the kind of features which you'll either enjoy and use or which you won't find strictly necessary, but their inclusion undoubtedly adds to the appeal of the software.

Installation is straightforward (you even get some music and images to while away the time) and operation is relatively intuitive

once you have mastered the basics. FDC is, however, yet another piece of sophisticated software with only a lightweight paper manual. Most of the ten pages consist of an odd, but useful, tutorial; it's odd because it uses the Cessna 182RG, with your co-pilot calling things like V1 and a 'welcome aboard' announcement. Nevertheless, the tutorial is an excellent introduction to the program and serves its purpose. To get to the real heart of the FDC, you'll need to read the onscreen manual; this runs to 250 pages and is extremely detailed, telling you all you need to know. There is plenty to learn because of the sophistication of the software, and it will consequently take you some time to master fully.

Using FDC at the same time as the ATC in FS2002 proved an interesting challenge. You will find both the controller and your first officer talking to you at the same time; this is realistic, and the solution is the same as in real life. You either learn to listen to two things at once, or ask ATC to "Say again", and then pause the checks until the R/T dialogue has finished. There were a few occasions when the captain/first officer 'challenge and response' conversation or calls either seemed to be missing or to progress at a snail's pace. This may well be a case of unfamiliarity with the software, or may have been affected by background tasks – nevertheless both effects were surprising. On a very positive note, aircraft performance is given in a multitude of tables that should always enable the heavy jets to be flown in the correct configuration for their current weight. This kind of information should be present in every sophisticated flight simulation, so it's extremely pleasing to see it here.

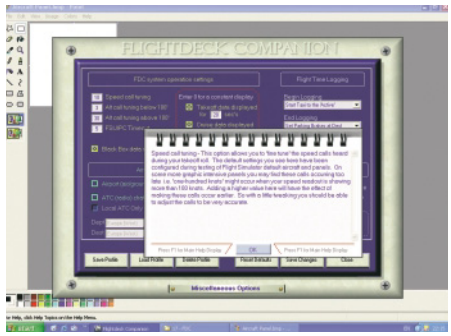
Many will consider FlightDeck Companion an essential addition to the simulated cockpit, whereas others will see less benefit in it; this is likely to depend on your level of experience and how you use your flight simulator. If you are a beginner who is grateful for any assistance you can get, FDC will help tremendously; it will not only ask pertinent and vital questions, such as whether you have lowered your landing gear, but will also perform some vital functions for you. FlightDeck Companion will also appeal to those who fly heavy jets and enjoy the addition of such peripheral realism. The package adds aural realism to accompany the visual realism that we have now come to expect, and will appeal to those who enjoy the sophistication of a product; it is well written and has a high degree of functionality.

On the other hand, the package will be less appealing to those who prefer to test their abilities by handling everything themselves, or to those who find the pre-flight elements a chore and prefer to start and finish on the runway. There are, of course, those who require absolute realism, for whom only the real checklists will do. Whilst you can buy real checklists for light aircraft for £10.00 to £15.00, however, the heavy jet equivalents are likely to be almost as scarce as actual opportunities to fly the actual aircraft.

If FlightDeck Companion sounds appealing, you are unlikely to be disappointed by what is undoubtedly a superbly designed and affordable package; there's no doubt that two crew members will make operations simpler than just one, so if it's good enough for the jet jockeys, why not try some teamwork yourself? ■

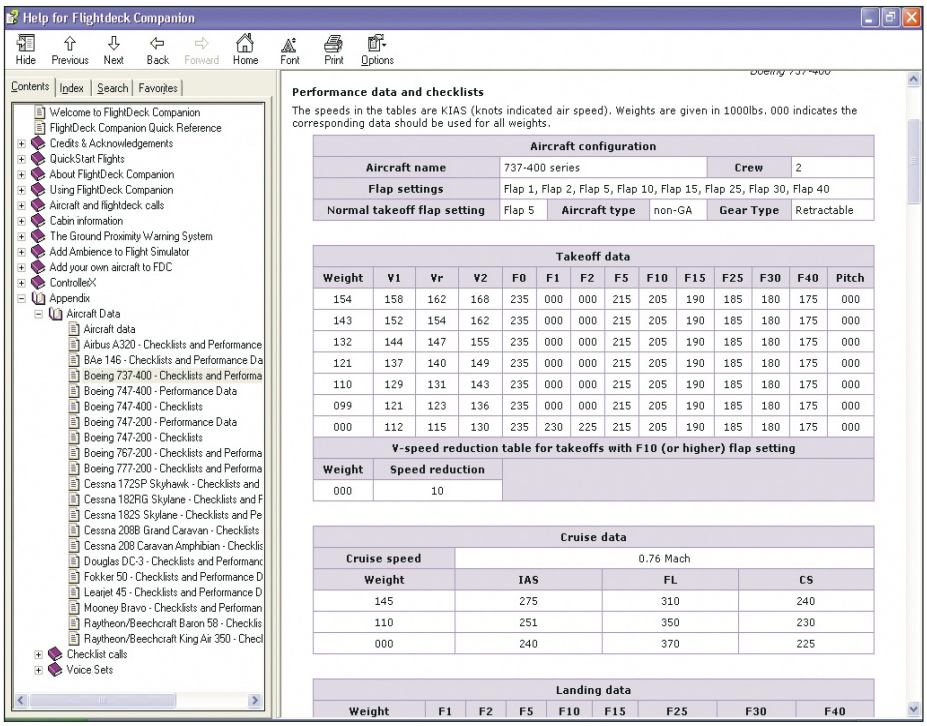
Stephen Heyworth

Fine tuning for aircraft management in the Performance File Editor

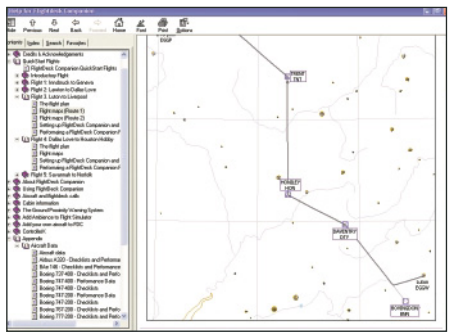


Help with the software is just a button click away

Full textual details of your flight in the black box


Help for Flightdeck Companion
Hide
Previous
Next
Back
Forward
Home
Font
Print
Options
Contents
Index
Search
Favorites
Welcome to FlightDeck Companion
FlightDeck Companion Quick Reference
Credits & Acknowledgements
QuickStart Flights
About FlightDeck Companion
Using FlightDeck Companion
Aircraft and flightdeck calls
Cabin information
The Ground Proximity Warning System
Add Ambience to Flight Simulator
Add your own aircraft to FDC
ControllerX
Appendix
Aircraft Data
Aircraft data
Airbus A320 - Checklists and Performance
BAe 146 - Checklists and Performance Da
Boeing 737-400 - Checklists and Performa
Boeing 747-400 - Performance Data
Boeing 747-400 - Checklists
Boeing 747-200 - Performance Data
Boeing 747-200 - Checklists
Boeing 767-200 - Checklists and Performa
Boeing 777-200 - Checklists and Performa
Cessna 172SP Skyhawk - Checklists and
Cessna 182RG Skylane - Checklists and F
Cessna 182S Skylane - Checklists and Pe
Cessna 208B Grand Caravan - Checklists
Cessna 208 Caravan Amphibian - Checklis
Douglas DC-3 - Checklists and Performanc
Fokker 50 - Checklists and Performance D
Learjet 45 - Checklists and Performance D
Mooney Bravo - Checklists and Performan
Raytheon/Beechcraft Baron 58 - Checklis
Raytheon/Beechcraft King Air 350 - Checl
Checklist calls
Voice Sets
Performance data and checklists
The speeds in the tables are KIAS (knots indicated air speed). Weights are given in 1000lbs. 000 indicates the corresponding data should be used for all weights.
Aircraft configuration
Aircraft name
737-400 series
Crew
2
Flap settings
Flap 1, Flap 2, Flap 5, Flap 10, Flap 15, Flap 25, Flap 30, Flap 40
Normal takeoff flap setting
Flap 5
Aircraft type
non-GA
Gear Type
Retractable
Takeoff data
Weight V1 Vr V2 F0 F1 F2 F5 F10 F15 F25 F30 F40 Pitch
154 158 162 168 235 000 000 215 205 190 185 180 175 000
143 152 154 162 235 000 000 215 205 190 185 180 175 000
132 144 147 155 235 000 000 215 205 190 185 180 175 000
121 137 140 149 235 000 000 215 205 190 185 180 175 000
110 129 131 143 235 000 000 215 205 190 185 180 175 000
099 121 123 136 235 000 000 215 205 190 185 180 175 000
000 112 115 130 235 230 225 215 205 190 185 180 175 000
V-speed reduction table for takeoffs with F10 (or higher) flap setting
Weight
Speed reduction
000
10
Cruise data
Cruise speed
0.76 Mach
Weight
IAS
FL
CS
145 275 310 240
110 251 350 230
000 240 370 225
Landing data
Weight F1 F2 F5 F10 F15 F25 F30 F40

All the help you're likely to need



Useful maps are included in the Help files

Review Score

Publisher: OnCourse Software

Price: £24.99 (inc. p&p)

Website: www.oncourse-software.co.uk

Developer: Dave March

At a glance: Assistance in the cockpit and added realism. Easy to customise to your particular needs and a well developed program.

System Requirements: FS2000/2002 (FDC also works in FS98, but not all features are functional.) 75Mb to 377Mb disk space

FSFlightMax

Power up your panels

Although many flight simulator aircraft are equipped with a range of cockpit instruments that typify those found in real aircraft, many more products have been designed to make the life of the GA pilot a less stressful affair. The Avidyne FlightMax 850 avionics device is one such device, and is now available to FS2002 pilots through the programming expertise of Sim Systems. It is an exact replica (within the constraints of FS2002) of the FlightMax 850 instrument, and provides a Collins radar module, TCAS traffic collision and avoidance system, lightning tracker, moving map and a digital charts module. All this comes complete with the genuine manuals and user guides, in PDF format, from the Avidyne Corporation – the manufacturer of the real FlightMax 850.

FSFlightMax runs within FS2000/2002, and communicates with the FS systems via the superb FSUIPC.DLL, developed by Peter Dowson, which you'll find on the cover CD. Unlike other instruments of its kind, FSFlightMax is not a gauge; it's a module designed to embellish all the aircraft on your system. The interface is similar to other MFDs (Multi Function Displays), where all the functions are accessed from a row of

You can align the instrument to always reference North

Positioning on a cloudy day? No problem with FSFlightMax

Whichever view you prefer, FSFlightMax remains on display

buttons down one side, combined with a pair of rotating knobs. You can use the normal point-and-click mouse method of operation, but there are hot key assignments for every available option, which you'll find are much easier to manage. The key strokes can also be assigned to programmable joysticks or controller cards.

When you launch the system, it will automatically load the navigation data for all the airports within a 500nm radius of your current position. You can then cycle through the various displays as you proceed on your flight, receiving constantly updated traffic information, weather data, track and authentic moving maps. This last feature is very nicely implemented using real digital sectional maps available from www.aeroplanner.com; they don't come as part of the package, unfortunately, but are very reasonably priced – $7.50 (a little more than a fiver) for the whole of the UK.

Once you've downloaded a map you have to calibrate it using an easily identifiable position such as an airport or other visual reference point. This sets a datum point and from then on your aircraft's position is shown accurately on the map. If you've planned your trip (as you should!) then the flight plan, including all waypoints, will be displayed on top of the map.

This is a complex piece of programming that will instantly appeal to those who enjoy their gadgets; it's not an essential instrument, but is certainly one that lightens the load for the pilot. During the lengthy review period it worked perfectly, and has little effect on those all- important frame rates. If you fancy trying FSFlightMax yourself, you can download a free evaluation version from the Sim Systems website. This is fully functional, but will stop responding after 20 minutes – unless, of course, you register, which you might well be tempted to do. ■

Joe Lavery

The different modes provided by FSFlightMax

Review Score

Publisher: Sim Systems

Price: $24.95 (£17.00 approx.)

Website: www.simsystems.com.au/fsflightmax

Developer: Sim Systems

At a glance: A useful program that will allow you to relax a little more on those cross-country excursions; it provides a complete monitoring system for traffic, weather and ground proximity. You won't get lost either!

System Requirements: Not specified

Recommended: P4 or Athlon 1.2GHz, 256Mb RAM, 32Mb 3D graphics card

Jane's Attack Squadron

Last year's model

The premise of Jane's Attack Squadron is enticing, according to the packaging: you get 14 aircraft, including fighters and bombers, as well as variants on many of these aircraft; there are missions which include bombing runs, bomber escorts, patrolling and strafing; there's a million square miles of satellite-accurate terrain, and a full damage model that recreates the effect of hits on your plane. It sounds great and, coupled with the reputation of Jane's simulations, many people will pick up JAS expecting it to be an improvement on the popular WWII Fighters package, only to be incredibly disappointed.

The flight model is poor, and the planes are almost uncontrollable in some cases. The trim controls don't trim the plane properly, making it impossible to keep to a heading and attitude without constant adjustments, and taking your hands off the controls will inevitably result in a plane wandering off course and eventually diving into the ground. The feel of the aircraft is poor, with bombers and fighters giving you the same overall response. Telling the difference in performance between an Me109 and a Ju88 is difficult.

The graphics engine is undeniably dated; your flight controls are a dark blur in front of you and, instead of reading altimeters and attitude indicators, you have to resort to the on-screen text displays. Sound effects, sadly, are also poor; all the engines sound like a constant drone regardless of throttle setting, and damage modelling is also limited.

One useful feature is the ability to pan around your cockpit to look out of the sides and top of the canopy (instead of the almost standard left-right-up settings). The aircraft themselves look good enough, but lack the level of detail required to generate gasps from onlookers. Actually finding the enemy aircraft in the sky is often difficult, as they are highlighted with a small light circle around them at distance, and so are often indistinguishable from the background. The much-vaunted ground terrain is a blur even at low flight levels, and contains little recognisable detail. Considering the advances made lately in sims such as IL-2, JAS really does look like a product which is three or four years old.

The single-player missions and campaign are limited in scope, and a wider variety of missions would have been a great improvement. You want to advance your pilot through the ranks in a campaign, winning accolades and promotions? Forget it. Multiplayer capability is supposed to be a big feature of JAS, but we weren't able to play for more than ten minutes or so without the sim crashing. There's a distinct shortage of opponents on the game servers, probably because more enticing online combat options are available.

B-17 in the thick of it, although the pilot might not notice the effects of any damage

There are, however, a few bright spots. JAS is easy to play, even though the keyboard controls are sometimes confusing, and the B-17 is easier to fly and use for bombing than in any more 'realistic' sim. You do get the chance to experience life in the gunner's and the bombardier's positions – a pleasing feature that makes the general disappointment even more frustrating.

If you have a friend who has never flown a sim before and doesn't want to face a very steep learning curve, then Jane's Attack Squadron might well fit the bill. Anyone else is unlikely to be interested in its three-year-old graphics engine, weak sound, and lack of realism. Xicat's European sales director has been quoted as saying that JAS was "developed to attract not just the hardcore gamer but casual gamers too". It certainly looks that way – a budget product in everything but the price. ■

Tim Parker

In spite of the sim's failings, the gunnery and bombing options are to be applauded

Plane detailing is reasonable, but not up to IL-2 standards

Turn the display up when the sun's out, and you can even see a few instruments

Review Score

Publisher: Xicat Interactive

Price: £34.99

Website: www.xicat.com

Developer: Mad Doc Software

At a glance: Great fun for the gamer, but less so for the flight simmer.

System Requirements: PII 400MHz, 128Mb RAM, 16Mb 3D graphics card, DirectX 8

Recommended: P3 600MHz+, 256Mb RAM, 32Mb 3D graphics card

MiG-21UM & Beechcraft Bonanza

The best of the best!

There's no doubt that the quality of flight simulator aircraft is improving steadily, as developers become more familiar with the new features they can use in FS2002; every now and then, we've noticed, a couple of models appear that really stretch the boundaries, both in terms of design accuracy and in visual appearance. So we present here two additions to your virtual hangar, both equally worthy in spite of being poles apart in aviation terms.

The first aircraft is from Carenado, the company who kindly allowed us to promote their superb Piper Tomahawk on the cover CD of Issue 15. In keeping with their policy of providing the FS community with brilliantly modelled GA aircraft, here they present a beautiful Beechcraft Bonanza. It's a gorgeous aircraft that most private pilots can only dream of owning, so flying Carenado's version is probably going to be 'as real as it gets' for most of us.

We're the first to moan about developers who cannot keep pace with the freeware designers, so it's good to find a couple of developers leading the field for a change. The model depicted here is a Bonanza F33A and, as far as how it looks, the screenshots tell you all you need to know. It really is an impressive creation – fully moving parts, transparent reflective windows, superb 3D cockpit, every conceivable lighting effect, and a paint job that defies belief.

Russian MiG pilots seem delighted with the detailing on their aircraft

The closer you get, the more detail you see

Beautiful on the outside...

…and inside as well

The cockpit has a custom panel with night effect gauges, and Carenado tell us that it's IFR-certified; this is probably under FAA rules – as far as we're aware our own CAA are yet to allow such a facility. The flight model and characteristics seem to fall within the published performance figures, but sadly none of us at PC Pilot has ever flown this six-seater, so that's more of an informed opinion than a conclusion drawn from experience. Nevertheless, it handles very well, is particularly gentle in the stall and, like many aircraft with this underwing design, has a tendency to float as you try to touch down. If you enjoy pottering about in light aircraft, Carenado's Beechcraft Bonanza is a must.

In complete contrast we cross the Iron Curtain… or travel to Canada, actually, to the home of Captain Sim in Toronto, the designers of this ageing MiG-21UM. To say that the modelling here is accurate is a bit like calling a Ferrari just a 'car'; of course, technically it is, but it's hardly an adequate description. When the developers enlist the help of no less than seven former Soviet Union fighter pilots, you get some idea of what we're talking about.

This is not just a single aircraft, by the way; it's a complete package containing ten different variants, highly detailed 2D and 3D cockpits, and one of the best manuals we've ever seen. You'd be well advised to read this, because not only are the cockpit controls all in Russian, but the instruments themselves are arranged and designed differently to those in Western aircraft. Having said that, the manual covers all areas in great detail, with clear colour pictures and enlarged animated pop-ups explaining many individual instruments. It's true that FS2002 was never designed for jet fighters, but low-level flying in the MiG-21 through some of the superb new scenery available is a sheer delight.

If you budget yourself to just two aircraft a year… make it these two. ■

Joe Lavery

MiG-21UM Review Score

Publisher: Captain Sim
Price: $24.95 (£17.00 approx.)
Website: www.web-captain.com
Developer: Captain Sim

Beechcraft Bonanza Review Score

Publisher: Carenado
Price: $15.00 (£10.00 approx.)
Website: www.carenado.com
Developer: Carenado

At a glance: Two fine examples of aircraft that are worlds apart, but equally notable for their outstanding quality.

System Requirements: Not specified

Recommended: P4 or Athlon XP 1500, 256Mb RAM, 32Mb 3D graphics card

Eastern Thunder

A mighty boom or a slight rumble?

IL-2 Sturmovik requires little or no introduction, and most of you already know just how great it is. In case you've just returned from a spell on Devil's Island, however, it's the incredible WWII Eastern Front combat simulation from Ubi Soft that has given Microsoft's CFS2 a real run for its money. But, in order to fully wrest the crown from Seattle to Chertsey, IL-2 needed the extra muscle that a range of expansions give to any title. This is where Eastern Thunder rolls in – the first add-on for IL-2 and probably the first from Just Flight for a non-Microsoft flight sim. The package consists of 28 extra missions as part of a campaign, and some new 'skins' for the aircraft. It sounds good on paper but, with different missions and campaigns already available over the Internet, a commercial add-on for IL-2 will need to add something beyond what is freely available. Does Eastern Thunder live up to the challenge?

The program installs quickly and easily, and finds your IL-2 folder automatically. During installation, you can browse through the well produced 68-page manual, which includes instructions in English and German, and briefings for each mission; the briefings are well written, and give you a good idea of what's to come. The historical background to the missions includes 'letters' written from the Front by pilots on opposing sides, which add considerably to the atmosphere.

There are 14 new missions available with the new campaign, which can either be played singly in the Single Missions section, or as a full-blown campaign. The box claims that 28 missions are included, which is perfectly accurate, but there are only 14 different missions, which can be attempted from either the Russian or German side. This makes the objectives relatively predictable; if, for example, your objective as a Russian pilot is to defend a convoy, as a German pilot on that same mission your objective would be to destroy it. Nonetheless, it's interesting to try your hand at both sides of the same battle scenario.

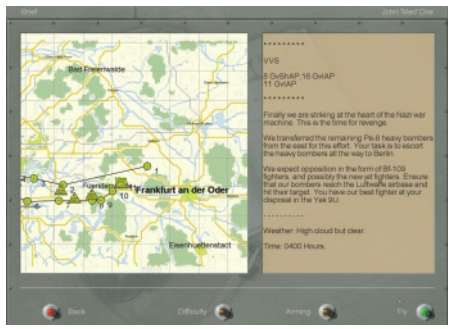
The missions themselves run the full gamut of dogfights to escorts, and ground support to naval strikes, and a hypothetical mission is also included; while they're a lot of fun, they can sometimes be rather hard. The first mission in the Russian campaign has you flying La-5s to defend your newly established base area. This wouldn't be too bad if it weren't for the dozens of German aircraft thrown at you about halfway through the mission. The missions succeed in portraying the different situations facing each side, but aren't noticeably any better or worse than IL-2's original missions or several of those freely available on the Internet. The five new skins included in Eastern Thunder didn't really make any impact on our flying abilities, but were a welcome cosmetic feature.

IL-2 itself comes with a very competent mission editor, and one criticism levelled at Eastern Thunder is that there's no point buying a box of missions when you can write them yourself. However, this is rather short-sighted if you apply the same logic to the latest novel you bought. A few hundred pages of paper and a pencil can be bought for next to nothing, so why waste money on the book when you can write one yourself? When you buy Eastern Thunder you're paying to a degree for the research that goes into making the missions realistic; in this respect it's certainly good value but not an exceptional expansion. What you get for your money is essentially a decent set of missions on CD and a proper paper manual. While Eastern Thunder makes no great claims otherwise, you might be left with the feeling of wanting more. Perhaps future add-ons will add more meat to IL-2 than this rather lean add-on. ■

Brian Rubin

Two LaGG-10s on their way to a mission objective

German ace Hartmann's Me109 is carefully recreated



Your map and mission briefing

I'm on your tail, Ivan!

This 109 is upsetting the gunner's borscht party

Review Score

Publisher: Just Flight

Price: £19.99

Website: www.justflight.com

Developer: Leonard Hjalmarson

At a glance: In spite of somewhat minimal content, Eastern Thunder is a reasonable addition to one of today's greatest sims.

System Requirements: PII 400MHz, 128Mb RAM, 16Mb 3D graphics card.

Recommended: PIII 800MHz , 256Mb RAM, 32Mb 3D graphics card, 3D sound card

CoPilot & EZ-VFR

Fuss-free flight planning and navigation

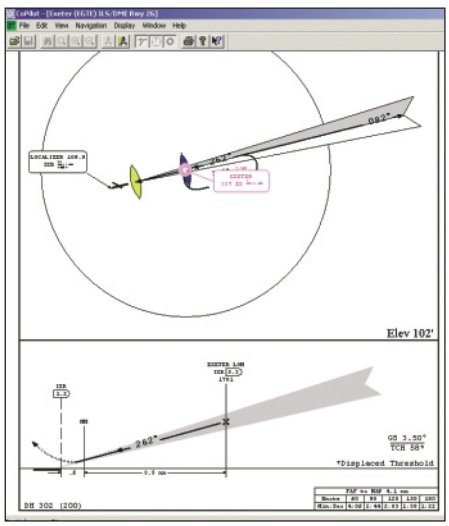
Once simulator pilots (and real ones as well, for that matter) have full command of the handling of their aircraft, the next stage is to master flight planning and navigation. It's all very well flying aimlessly round in circles, but if you actually want to go somewhere, you need to have the confidence in your own abilities to actually get there.

CoPilot is designed to give you that confidence but without having to acquire the fairly complex knowledge required to do it the conventional way. Essentially, it interfaces with Flight Simulator to produce flight plans, charts, approach plates and real-time GPS navigation within the simulated environment. Because it relies on information sourced from the scenery files installed on your own computer, it's not restricted in any way; no matter how many scenery areas you add, it will always reflect your own particular virtual world. The program also includes a full set of maps covering most of the world, which show airports, NDBs (Non Directional Beacons), VORs (VHF OmniRange navigation systems) and runway details.

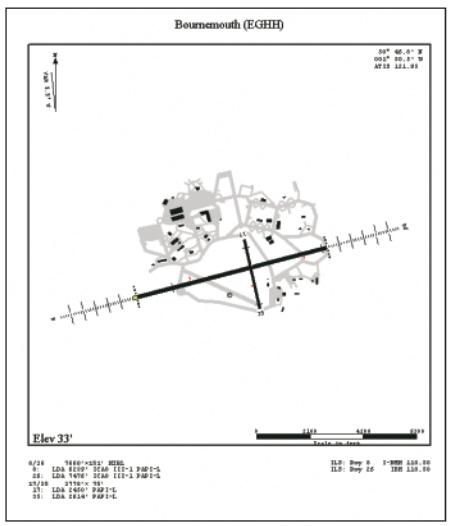
There are two methods of creating flight plans; you can either click on the map at your departure point and then at each successive waypoint, effectively drawing the route as you go, or you can use the QuickPlan button that only requires the departure and destination airports to automatically plot an appropriate route for you. When you initially set up the system you can define the transmitter range, and route deviations CoPilot will use while plotting a course. This means that you'll never be routed out of transmitter range, and the course deviation setting determines how far away from the optimum course CoPilot will look for other navigational aids. We found this to be very effective; the program always offered a sensible route that stayed within the parameters we had set.

The CoPilot flight plans show each of the waypoints, airport ID, radio frequency, elevation, latitude and longitude, course to fly, distance to the next waypoint and NDB frequency (if available).

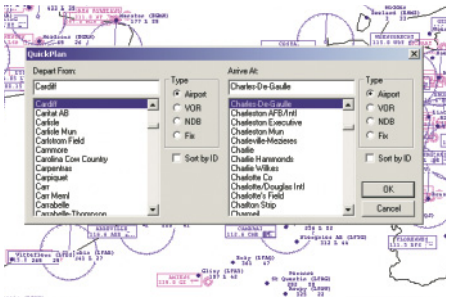
Clicking on an airport in Map view will bring up an information box full of data relevant to



An approach plate is usually provided for ILS-equipped destinations

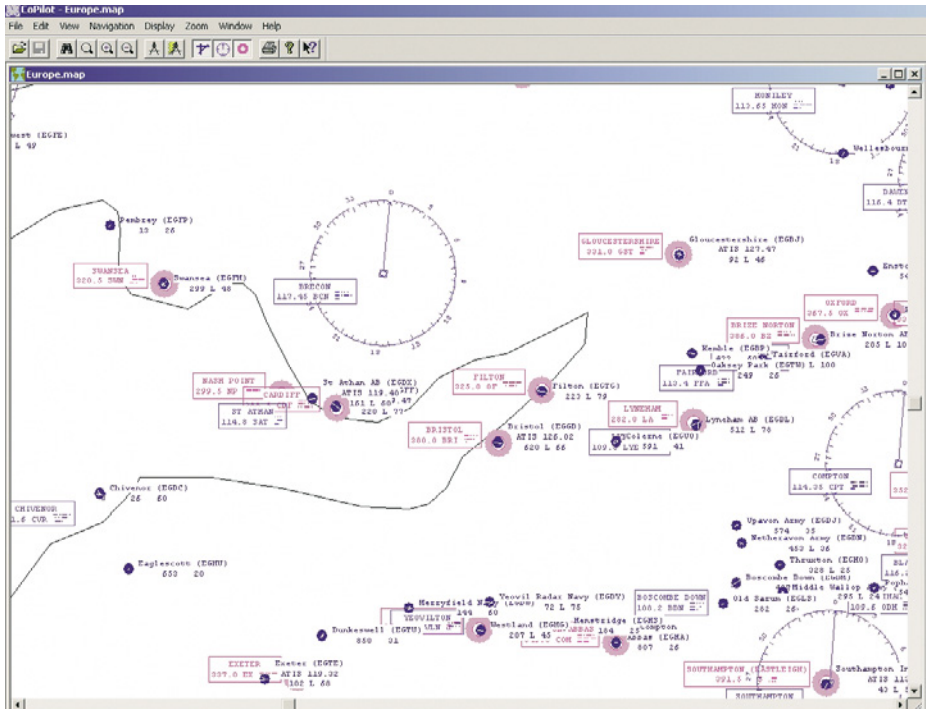


Airport schematics for all major airports are included



QuickPlan facility only requires departure and destination airports

The GPS instrument mounted in the default Mooney



The maps provide a reasonable level of detail

that location, including the length and surface details of the runways, lighting arrangements, and whether fuel is available. Another button, marked Diagram, shows an overhead schematic of the airport layout, together with very accurate approach plates on runways equipped with ILS (Instrument Landing Systems). These include holding patterns, headings to fly to intercept the localiser, and decision and missed approach heights – essential if you want to practise precision approaches in IFR conditions. There is a Print Preview option, and naturally you can print the plan, or any of the other schematics, in a format that suits you best. The detail and zoom level of the printout is determined by the current on-screen view.

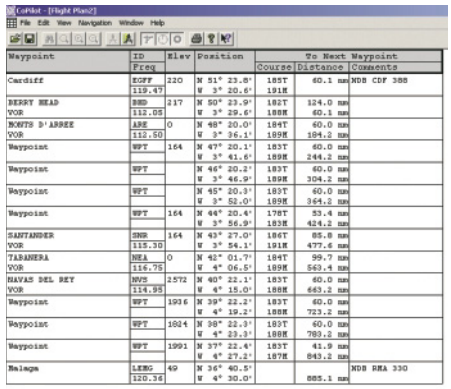
Before you can execute your flight plan in FS2002 you'll need to install the CoPilot GPS gauge into the aircraft you're going to use. This is a straightforward process because there's a separate program designed to do just this; it lists all the aircraft currently installed on your system, then it's simply a matter of selecting the aircraft and clicking on the Install button. Once you've installed the GPS and created a flight plan, you can launch FS2002 and set up your chosen aircraft at the departure point. The CoPilot GPS will initially be displayed in the top left corner of the screen, but it can be easily moved and is fully scaleable, so you can place it wherever you want.

Once on board the aircraft, you need to press the SET Destination button to select the plan you've just created, and then click the AP button after take-off to engage the autopilot. The GPS has a number of different modes that show waypoint data, time to go, distance, heading and so forth – in fact all the information you would expect from this type of instrument. If you [Alt]-[Tab] back to the main CoPilot program you can check your progress on the map in real time. The authors suggest in the manual that a spilt screen view would allow you to see both the cockpit and map displays at the same time, although we think that a better option is to have the CoPilot display shown on a separate monitor, perhaps using one of the latest video cards that support two monitors.

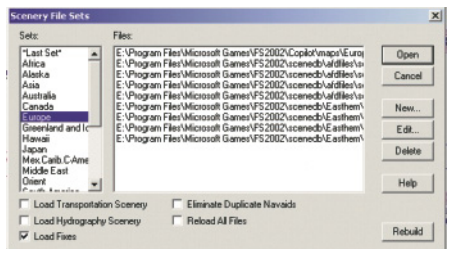
In addition to the CoPilot software, Abacus has included a rather novel program that was previously sold separately. EZ-VFR is so simple you wonder why no one thought of it before; it's basically a utility designed to get you to any airport within a predefined radius of your present location. It does this by displaying both the ICAO code and heading to any airport within the parameters you've set. You can show all the airports for hundreds of miles if you like, but the screen would get rather cluttered; it's far more sensible to define a range of, say, 40 or 50 miles, which in the UK would almost certainly show a couple of likely candidates. In the US or Australia a wider range might well be necessary. The idea is to pick a suitable destination and then follow the heading displayed on the screen; you'll eventually arrive over your chosen airfield ready to take landing instructions from ATC.

This is a brilliantly uncomplicated product, and particularly suitable for new pilots who don't yet understand (or aren't interested in) the complexities of flight navigation. If you're already an accomplished IFR pilot, however, then you'll find the flight management systems on many modern aircraft are far more sophisticated than the CoPilot GPS. Nonetheless, the charts, flight planning capabilities and other documentation will be extremely valuable – whatever your level of competence. ■

Joe Lavery



A typical flight plan – looks like Joe's planning his holiday!



Scenery data is taken from your own personal installation of FS

Review Score

Publisher: Abacus

Price: £24.99

Website: www.abacuspub.com

Developer: Abacus

At a glance: CoPilot has always been a popular addition to the flight sim arsenal, so this updated version will undoubtedly appeal to the many existing owners. New users, however, might feel that some of the utilities provided have already been adequately implemented within FS2002.

System Requirements: PII 300MHz, 128Mb RAM, 3D graphics card

Recommended: PIII or Athlon 700MHz, 133MHz Bus, 256Mb RAM, 32Mb 3D graphics card

Mosquito Squadron

Take home 'the plane that got you home'

In 1938 de Havilland began designing an aircraft that could be used for unarmed bombing or reconnaissance; the theory behind this rather radical idea was that, if the speed and altitude of such an aircraft were sufficiently high, it would have no need for defensive armament and could observe or attack targets without interference from enemy defences. Using two of the latest Rolls Royce engine, the Merlin, the aircraft would be constructed from 'non-strategic' materials, namely wood.

This radical concept (at the time) did not interest the Air Ministry, and de Havilland was told not to bother sharpening their fretsaws. After the outbreak of war, however, the effects of a potential U-Boat blockade on supplies of steel and aluminium suddenly made the idea of a high-performance wooden aircraft seem far more logical. The Air Ministry cautiously gave de Havilland the nod to proceed further with their designs in December 1939, and this resulted in an order for 50 aircraft to Air Ministry Specification B.1/40 on 1 March 1940. A few hiccups in production followed Dunkirk but, on 25 November 1940, the prototype aircraft, now called the Mosquito Mk I, took its maiden flight. Early impressions were very promising and, when the Mosquito was demonstrated to a sceptical military, it was an aircraft that could fly at almost 400mph, manoeuvre like a fighter, and run incredibly well on one engine.

By 1942 the Mosquito was flying in various guises, as a bomber (B), a night-fighter (NF), a photo-reconnaissance aircraft (PR) and a fighter-bomber (FB). For anyone interested in combat flight simulation it's arguably the last version that offers the most excitement, and Just Flight's Mosquito Squadron brings the 'Wooden Wonder' to life in its FB.Mk VI incarnation. With four .303 machine guns, four 20mm cannons, bombs and rockets, the FB was a formidable aircraft and a true multi-role machine. It was ideal for everything from precision bombing to dogfighting, which explains why it was chosen for a CFS2 add-on, and why it's an exciting prospect to fly in FS2002. It's been well documented that the Mossie was well loved by her crews. She was fast and light, could climb like a bat and, in spite of her wooden construction, could also take a lot of damage.

You can install the virtual version in CFS2 or FS2002 without any bother, although not surprisingly you'll only be able to access the missions or campaigns in the sim with 'Combat' in its title. Any of the 21 historical missions can be accessed individually, or the pilot can choose a campaign where, as his experience develops, so does his score and promotion prospects. You can even cheat, if you prefer more variety, and fly the historical missions with a different aircraft. Flying the Mosquito in FS2002 is perhaps more pleasing aesthetically, since the terrain is obviously greatly improved over that of CFS2, but flying a Mosquito with no weapons or missions is to miss a great slice of the action available.

On a 1GHz AMD Athlon system with 256Mb RAM, we set resolution at 1024x768 and 32-bit colour; the frame rate was fine, even with graphic detail set to High. 16-bit colour looks almost as good (with the exception of the skies) and improves performance significantly on lower-end systems or those with older video hardware.

As an aircraft, it's forgiving to handle and relatively easy to trim. It certainly is a powerhouse, and turns quite well, thanks

In-flight mission maps come in handy

Inbound to the chemical plant…

… and exit target area after the strike

partly to the torque provided by the twin Merlins. Stall characteristics surprised us, and recovery from stalls was more difficult than it is in many fighters. You don't want to stall this aircraft anywhere below 5,000 feet. The Mosquito model is impressive, although the textures are not as detailed as those of the default aircraft in CFS2. The cockpit panel, however, is particularly well done. Our only surprise was that, when taking off at dawn, the L switch didn't bring up any panel illumination. The missions are impressive in their variety, and not only expose the pilot to a great variety of combat conditions, but also to a wide variety of enemies and terrain.

Enemies include all the standard German fighters. The Me109s and Fw190s are all dangerous adversaries to encounter, though evenly matched we'd prefer to take on the less manoeuvrable Fw190. The four 20mm cannon on the Mosquito are a match for the firepower of this powerful fighter, but the Mossie has no comparable armour and is prone to burn when hit by explosive shells.

Some of the historic missions we flew included the Baedecker Raid, the Norwegian chemical plant strike, and a Panzer attack. You can also fly the famous Amiens Prison raid (Operation JERICHO), intercept V1s, attack enemy shipping and participate in Operation CARTHAGE. Briefings are accessible and attractive, and nicely presented within the CFS2 interface; they contain just the right amount of information.

The Baedecker Raid will expose you to the Fw190; the strike on the chemical plant takes you into the coastal regions of Norway and is a long flight, which cranks up the atmosphere as the tension builds and you climb over the mountains. In the Panzer attack you're searching in the mountains for reported tank activity, but are never far from Luftwaffe airfields – the situation can quickly get out of control.

One of the advantages of flying Mosquito Squadron in Combat Flight Simulator 2 is the inclusion of wingmen and the ability to command them. The 'Aircrew Manual' included in the package devotes two pages of instruction to wingman command and interaction. We were grateful to see this, as we needed the reminder and were spared the trouble of digging out our CFS2 manual. Our wingmen's performance was predictable; they weren't complete aces, but they were helpful and usually held their own, or at least held the fighters at bay while we made our escape! Yes… we did lose a few wingmen as we worked our way through the missions.

The wingmen also add the atmospheric touch of voice interaction. Orders are promptly acknowledged and swiftly obeyed. It was somewhat disconcerting to hear the damage reports come in, of course, and we were always disappointed to hear when a Mosquito crew had to abandon ship.

All the solid combat features of CFS2 are present and correct. During a mission it's possible to access the mission map, which not only shows your route but also your target location and necessary goals, and allows access to a mission log. Your flight will pause while you look at the map, and you can even zoom in and out on the map and pan around; this is a useful way to ensure that you have actually completed all the goals before you leave the target area.

Other standard CFS2 features include the tactical map, additional windows, and the enemy indicator. Padlocking an enemy takes you into virtual cockpit mode, and the enemy location relative to your aircraft appears on your tactical map (you can turn these features off if you want more realism). Enemy bases are well defended, and bandits will try to lure you into AA range. Difficulty can be set at the usual three settings, but we flew at Medium and found the missions challenging but fun, with AA fire dangerous but not unavoidable.

The 32-page manual also includes a couple of pages of historical information on the development of the Mosquito variants, and another page on aircraft operation. Strangely absent is the one we searched for – a single page providing operational data such as the best climb rate at speed, recommended cruise speed at altitude, and recommended manifold pressure. The working gauges are wonderful, but a little redundant without the basic operating information.

Overall, Mosquito Squadron brings to your PC an excellent aircraft that was tremendously exciting to fly 60 years ago and still is today. Add to this some well-researched missions, scenery of RAF Methwold (close to the present-day base at Lakenheath) and good documentation, and you get a package that's good value and well worth a place on your hard drive. ■

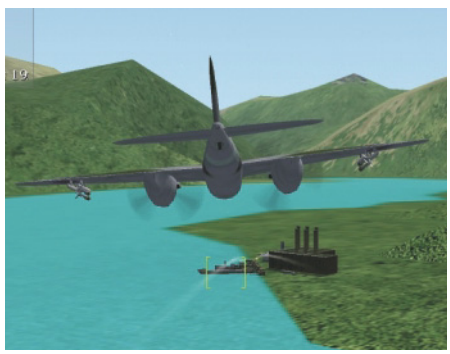
Leonard Hjalmarson

The authentic Mk VI panel is gorgeous

Dramatic skies in CFS2

We should have known that Fw was trouble…

Who's been letting the side down?



Lining up for a rocket attack

Review Score

Publisher: Just Flight

Price: £24.99

Website: www.justflight.com

Developer: Blue Arrow FS

At a glance: One of de Havilland's finest gets the FS accolade it deserves.

System Requirements: PII 400MHz, 64Mb RAM, 16Mb 3D graphics card

Recommended: PIII 450MHz, 128Mb RAM, 32Mb 3D graphics card, 3D sound card

TO POSITION TRACE VERSION OVER COLOUR PRINT
DELETE SMALL WINDOW
FLAT FRONT SCREEN
4 x 303 MACHINE GUNS
4 x 20mm CANNON
HAVE NOT DRAWN IN REVISED ENTRY DOOR. WOULD NOT LOOK GOOD FROM THIS ANGLE. SUGGEST IT BE 'CLOSED'!
NOTE BOMB DOORS FORWARD EDGE IS MOVED BACK
DELETE SMALL WINDOW
DELETE BOMBER VERSION ENTRY HATCH
DELETE
DELETE
SUGGEST LEAVE LADDER WHERE IS FOR SIMPLICITY. MAY BE QUERIED.
'G's COULD BE LEFT FOR 'ATMOSPHERE' BUT MAY BE SMD TO IDENTIFY G-XD OF 139 SQN.
PC CD-ROM
Mosquito Squadron
PC CD-ROM
Mosquito Squadron
PC CD-ROM
Mosquito Squadron
PC CD-ROM
NEW ACTION for Combat Flight Simulator 2!
Mosquito SQUADRON

Wilf Hardy's original painting, alterations for the final box design, the three initial proposals, and the box as you'll see it in the shops

Mosquito Squadron – The Story behind the Box

From the drawing board to the shelf by way of Amiens Prison

If you've read the review of Just Flight's Mosquito Squadron elsewhere in this issue, you'll see that we remarked on the quality of its packaging and documentation. But have you ever wondered what goes on behind the scenes when a new product goes from a few files on a developer's hard drive to a box on a shelf at your local software emporium? Isn't it all terrifically dull? Don't they just get a picture and slap it on the box, then put together a few pages of technobabble and an inaccurate history cut and pasted from the Internet?

There's actually a lot more to boxes and manuals, as we discovered when we took a look at the process involved in creating Mosquito Squadron. Little did we know what a fascinating story would unfold when we planned a small feature on this subject.

For the design of their boxes and manuals, Just Flight (and many other games publishers) use an established design house based in Cambridge called Fink Creative; it's likely that if you've ever been into a large software retailer you'll have seen something they designed. Fink's James Lawrence talked us through the process of getting a product such as Mosquito Squadron off the ground.

It usually begins with a brief from the publisher, who provides an overview of the product. The Fink team is familiar with flight sim add-ons and all things airborne; in fact James used to work for the RAF, and has been known to correct inaccuracies in manuals that the 'experts' have missed. Once they have a feel for the content of the product, they produce a set of preliminary ideas for the publisher. In the case of Mosquito Squadron they proposed the three designs which you can see here.

James told us that if they had been designing the box a couple of years ago they would have only considered using photographs, in order to ensure a high-quality image. More recently they've been able to experiment with screenshots thanks to the greatly increased quality of flight sim graphics. For Mosquito Squadron they based their designs on two photographs and a painting by Wilf Hardy, the renowned aviation artist. After much debate the publishers chose the Wilf Hardy image for the box.

It was at this point that one of the team noticed that the aircraft featured in Mosquito Squadron was a fighter-bomber version with enclosed nose, and Wilf's painting depicted a glass-fronted bomber version. Under normal circumstances this would represent a substantial spanner in the works, but Wilf was contacted and, after some discussion, sent James a set of drawings showing how the Mosquito in his painting would look if it was a fighter-bomber. Working from Wilf's drawings,

James re-styled the picture and before long Just Flight was presented with an FB.Mk VI in glorious oils. All that remained was to lay out the text for the box and the manual.

Just Flight compile their manuals in two stages. Initially, the product manager turns the brief notes from the software developers into a user-friendly document, and can expect to add tips and suggestions during the software testing process. According to Alex Ford, Just Flight's product manager, "We always keep a close eye on technical support queries, and if a user has a problem that we haven't covered in a manual we'll add it to future publications. Manuals for CFS2 products, for example, always include an overview of CFS2 commands to save users having to jump from one manual to another."

Once Alex's team have finished with it, the manual is edited and historical data, charts, tables and other information are all added. At this stage the authors of the manual got an unexpected surprise. Having come across an interesting account of Operation JERICHO, the Mosquito raid on Amiens Prison that is included among the missions, James passed it to Just Flight's researcher; together they delved a little further into the story of Group Captain Percy 'Pick' Pickard who, together with his navigator Bill Broadley, was shot down and killed on JERICHO.

The Amiens raid has gone down in history as one of the most daring ever staged by any aircraft. A force of 18 Mosquitoes flew to the heavily defended Gestapo prison at Amiens and breached the metre-thick walls with pinpoint accuracy, allowing 258 prisoners, including 50 members of the French Resistance, to escape. Pickard, who commanded the raid, saw that the objective had been achieved by 464 and 487

Alex 'Scotty' More with 149 Squadron - just before he appeared in Target for Tonight

Pick Pickard and Scotty as 'Mac' in Target for Tonight

Percy 'Pick' Pickard and Bill Broadley (Pickard's navigator on Operation JERICHO) with some of the poignant images from the manual, supplied by Group Captain Pickard's granddaughter, Nicole Pickard

squadron aircraft and sent the rest of his force (21 Squadron) back to base. Unfortunately he paid the ultimate price for his bravery in remaining over the target for so long to direct his force, and was shot down by an Fw190. Percy Pickard was 28 and his navigator J.A. 'Bill' Broadley, was just 21.

When Pickard was mentioned to an ex-RAF aircrew member on the Just Flight team, his first comment was, "Of course, you knew Pickard was a film star? He was the pilot in *Target for Tonight*". This is a particularly famous film made by the Crown Film Unit during the war, which uses real aircrew as actors, and tells the story of Wellington 'F for Freddie' as it goes on a night raid. You can still get it on video and we'd thoroughly recommend it. The dialogue may be dated, but the flying is timeless.

The researcher duly followed up this lead and came across a graphic designer's website that intriguingly included some information about Operation JERICHO and *Target for Tonight*. When he saw that the webmaster's name was Nicole Pickard, the mists began to clear. After an exchange of e-mails it transpired that Nicole was Percy Pickard's granddaughter, who provided some interesting information about her famous ancestor. She very kindly allowed some personal photographs to be included in the Mosquito Squadron manual, and also some very poignant images of an altimeter dial and a cannon shell from Pick's aircraft (Mosquito FB.Mk VI HX922 EG-F) that were recovered from the crash site by aviation archaeologists.

This made for a fascinating story, but there was more to come. Just after Mosquito Squadron was released, the publishers received a call from Evan More, an airline pilot living in Scotland, and another fascinating chapter unfolded. A keen flight simmer, Evan had purchased Mosquito Squadron and, seeing the section in the manual about Pickard, felt he had to get in touch. His father, Flight Lieutenant Alexander 'Scotty' More DFC, was also in *Target for Tonight* and played Pickard's Glaswegian navigator, Mac. In reality Scotty was an expert navigator and had already seen a lot of real action, including bombing the Piaggio works in Italy and using the first 4,000lb Cookie bomb, in a raid on Mannheim.

Among his many wartime adventures, Scotty went on a Victory Bonds tour of the USA (to drum up revenue from US citizens) with Roy Rogers, Dale Evans and the actor Sir Cedric Hardwicke, who was Pick Pickard's brother-in-law! When Scotty returned to England he crewed on Lancasters and Mosquito bombers, which brought the whole story full circle. Sadly, Scotty More has passed away, but Just Flight were extremely grateful to his son Evan for filling in some more pieces of this jigsaw.

Boxes may have got smaller and printed manuals are thin on the ground these days, but it's clear that there's more to them than might at first be apparent. ■

Derek Smalls

Helicopter Flying

It's all about co-ordination...

Since its introduction into Microsoft's Flight Simulator, the helicopter has remained one of the hardest aircraft to fly. Helicopters require precisely co-ordinated control between hands and feet, because the majority of operations that you perform with one control will mean that you have to do something simultaneously with the others, and they are relatively unstable in the hover or slow flight. Helicopters are flown by mere mortals like the rest of us, however, so flying them should be within your capabilities.

Before delving into how helicopters handle, it's worth understanding how they function. Although you will fly your helicopter with the same controls as for an aeroplane, i.e. stick, pedals and throttle, the way it responds is fundamentally different. This is especially true when flying at low speeds close to the ground or hovering, which are both critical skills required during take-offs and landings.

Rotors and controls

The normal helicopter has two rotors – a main rotor and a tail rotor. The main rotor provides all the lift, and whirls in a roughly horizontal plane above the helicopter; each blade on the main rotor is an aerofoil, and they act just like the wings on an aeroplane. Whereas the lift on an aeroplane is generated by wings attached to the plane moving forwards, helicopter rotor blades get their lift because they are driven through the air, even when the helicopter is stationary. Nevertheless, the physics remain exactly the same – an aerofoil is being driven through the air, and it is only the mechanism for driving it through the air that is different.

Once the aerofoil is moving through the air, increasing the angle of attack on the aerofoil will generate more lift. In an aeroplane flying at a constant speed, this can only be done by pitching the whole aircraft upwards. With a helicopter the angle of attack of the rotor blades is increased by twisting them so that they are angled further upwards; this is exactly what happens to make a helicopter climb in the hover, although all the blades in the main rotor must be twisted by the same amount. The pilot does this by lifting the collective, which gets its name because it twists all the rotor blades by the same degree – in other words, collectively. See Figure 1.

The amount of lift from each rotor blade is proportional to the amount it is twisted, i.e. its angle of attack. One of the ingenious design features of the helicopter is the ability to dynamically change the amount of twist on the rotor blade at different parts of its circular path. So, for example, it's possible to twist the blade more when it's to the left of the helicopter, and less when it's to the right. This in turn generates more lift on the left and less on the right, which rolls the helicopter to the right. Each time the rotor blade performs its circular route, it has to twist to the steeper angle and then back again to the shallow angle. This cyclical behaviour is controlled by the cyclic control, which is normally simulated by the joystick on a PC. Moving the joystick to the left, right, front or back makes the corresponding change in the twist of the rotor blades, giving the corresponding change in lift around each blade's cycle, and thereby controlling the helicopter in both roll and pitch. See Figure 2.

Raising the collective increases the lift, but it also increases the drag on the rotor; as a result, the rotor needs more power to drive it through the air, in just the same way as driving most vehicles up a hill requires more power. To compensate for this, the throttle has to be increased. On many helicopters the throttle is a separate control, usually a motorcycle-style twist grip on the end of the collective. The pilot must co-ordinate the throttle with the collective movements to ensure that the rotor RPM stay in the normal operating range. Fortunately for us, most simulators handle the throttle automatically, thus removing one element of complexity.

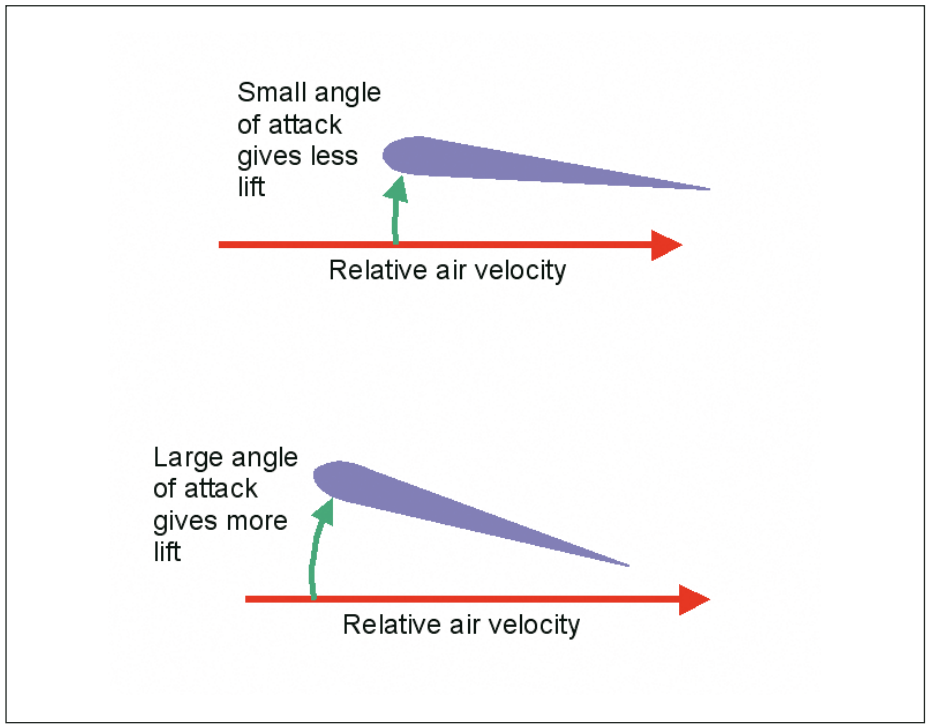

Small angle of attack gives less lift
Relative air velocity
Large angle of attack gives more lift
Relative air velocity

Figure 1. Increasing the angle of attack of an aerofoil at a constant speed will generate more lift

The engine in a helicopter drives the rotor relative to the fuselage. When the helicopter skids are on the ground the fuselage cannot move, so the rotor turns. When the helicopter is in the air, however, the engine is just as happy to leave the rotor stationary and turn the fuselage. In fact the engine tries to do both – turn the rotor blade one way, and the fuselage in the opposite direction. The fuselage is much heavier than the rotor, so the rotor turns quickly in one direction and the fuselage turns slowly in the opposite direction. Yes, that's essentially Newton's Third Law, 'To every action there is an equal and opposite reaction'.

Without something to counteract this behaviour, it would be impossible to hover, and this is where the tail rotor comes into play. The tail rotor is another set of aerofoils that generate lift depending on their angle of attack. By setting their twist to exactly the right amount, the thrust from the tail rotor can exactly match, and hence prevent, the fuselage's tendency to rotate in the opposite direction to the main rotor. There is an additional bonus to the tail rotor; the pilot can control the amount of force from the tail rotor, and the direction in which it is applied, so as well as simply balancing the torque reaction from the main rotor, the pilot can positively yaw the helicopter. This is done using the pedals; pressing the left pedal yaws the aircraft to the left and the right pedal swings it to the right.

Hover taxiing should be done at low speed

Flaring to reduce speed for the landing

Unfortunately all these aircraft dynamics interact with each other and therefore they

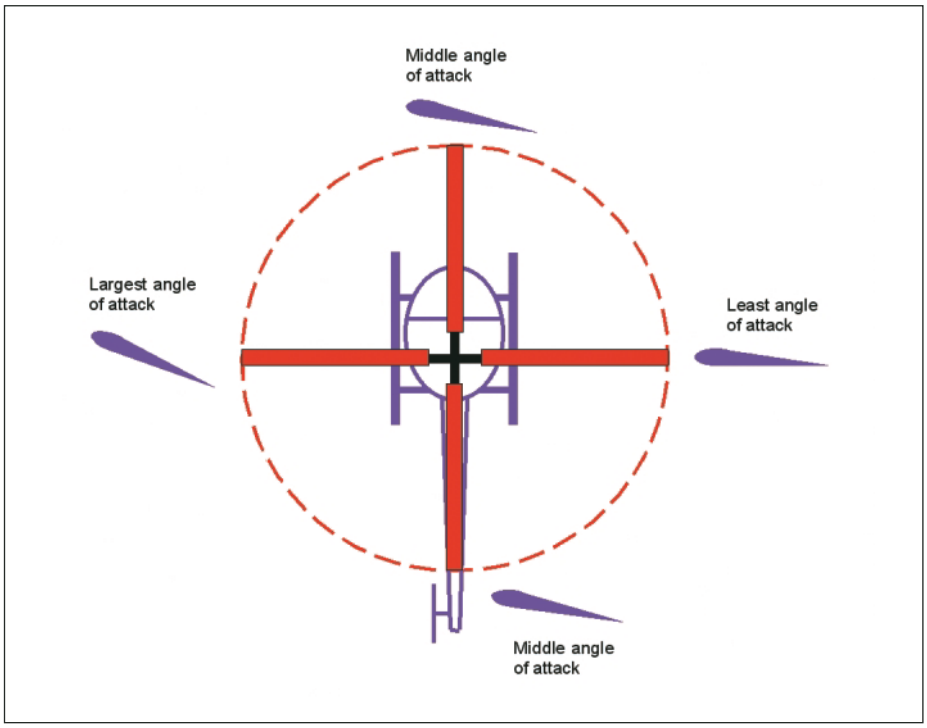


Figure 2. The cyclic control varies the degree of twist of the main rotor blades, in this case rolling the helicopter to the right

Expect to see a lot of ground when you start your take-off transition

all have to be controlled simultaneously. Raise the collective and the main rotor generates more lift, but at the same time it generates more drag and hence needs more power. More drag and more power also mean more torque reaction, so the tail rotor has to be adjusted with the pedals. As more power is required, the throttle has to be increased. At the same time, the change in tail rotor thrust means that the helicopter will want to move sideways, so this has to be counteracted by moving the cyclic. Here you can see that an apparently simple manoeuvre must be controlled using inputs to all the major controls. Add to this the fact that helicopters are extremely sensitive to control inputs, and it's clear why so much practice is needed.

The main rotor can only produce thrust in one direction, and you can control the direction in which that thrust is directed. If the helicopter is level in roll and pitch (or, more accurately, if the main rotor is level) the thrust is downwards. As soon as the helicopter changes from the level, the thrust is no longer vertical and the helicopter will move in the direction it is tilting. Thus to make a helicopter move forwards, it is tilted forwards (nose down) to direct some of the main rotor thrust backwards. Similarly, to slow down and stop a helicopter moving forwards, it is tilted backwards to direct some of the thrust forwards. Exactly the same principles apply to starting and stopping sideways or backward movements.

Hovering low

Now is the time to get airborne, so position yourself at your favourite airport ready to take off. It's sensible to switch 'Ignore crashes' on, as there is a strong likelihood that initially you will suffer regular crashes, and ignoring them will save you waiting for your simulator to reset each time. Make sure also that you have a good view of the runway by hiding the panel; this is critical. We'll start by lifting off into a low hover and settling down on the runway in the same place. As always in helicopter flying, you'll have many things to do at once, so you need to practise them until they become automatic; your mental processing power needs to be reserved for procedures such as ATC communication, looking out for obstacles, checking wind direction, setting radios and so on.

The first thing you learn is to keep the helicopter pointing in one direction using the pedals (unless, of course, you are deliberately turning around, but don't try the advanced stuff yet). This is difficult at the best of times, and close to impossible without rudder pedals. Very slowly raise the collective (increase the throttle) until the helicopter starts to become alive. Don't watch your instruments, as they are the least of your worries; you should keep looking at something in the distance, such as the far end of the runway. As soon as the helicopter even thinks about turning, use the rudder pedals to keep the helicopter pointing at the same distant spot. Make sure you don't get more than two or three feet off the ground and, as soon as things begin to get out of hand, lower the collective (close the throttle) and touch down again. When you have done this a few times, you'll start to know roughly how to position the pedals for take-off, although any change to the collective will mean a change of pedal position as a result of the alteration in rotor drag.

If controlling direction with the pedals was the only problem, hovering would be easy. Unfortunately it's not! The next thing you need to control is pitch and roll; at the same time as keeping the helicopter heading in one direction with your feet, you must keep it level with your cyclic / joystick. Don't worry about the inevitable slow drift until you can keep the aircraft relatively stable in the air. Once you can do this, you should find that the drift is not actually too great. If you are having difficulty maintaining control, set the realism to 'Easy', as this dramatically improves the stability of the

aircraft. This may feel a bit like cheating but it's worth doing, at least during training. Real helicopters are statically stable but dynamically unstable, because of complex effects like flapback. Despite this, the flight dynamics of some helicopter simulations are even more sensitive than the real thing, so the choice can often boil down to either making it unrealistically hard to fly or a little too easy; making it too easy, therefore, is usually the better option.

As soon as you take off, especially if there is any wind, you will drift in one direction or another, and you'll need to apply a small amount of cyclic stick in the direction you want to go. This is where you have a slight disadvantage on a simulator, because you won't be receiving any information from your peripheral vision as you would in the real thing, and the seat of your pants will tell you absolutely nothing.

To complicate things ever further, there is a phenomenon called tail rotor drift. The torque reaction from the main rotor is controlled by a force from the tail rotor. The tail rotor force not only prevents the helicopter from spinning, but it also adds a side thrust to the helicopter which pulls it sideways, usually to the right. To prevent this movement, you must add a little left stick. Fortunately it is unlikely to prove difficult for you because you will simply take the necessary actions to hold position. See Figure 3.

A stationary low hover is one of the hardest things to master in a helicopter, so don't expect to crack the technique in five minutes on anything but the easiest settings; you'll probably need to spend several hours developing this skill. It's often described as being like trying to balance a golf ball on top of a basketball, and it will certainly feel like that at first. If you are going to get disheartened at all, then it will be at this stage so, to keep your spirits up, take short hops to some new scenery every so often. After each spell trying to master the low hover, you will find that your short hops become easier, and safer, each time. Your confidence will grow accordingly.

Short hops

This is definitely not the way to fly a helicopter, but is a good handling exercise. For take-off, your objective is to enter forward flight as quickly as possible, making the period of precarious slow flight as short as possible. Fully raise the collective, briskly but smoothly, to launch the helicopter into the air, and use the cyclic both to keep the nose fairly well down and to keep level in roll. Concentrate hard on controlling direction with the pedals – it's very easy to forget to use the pedals for directional control and to try to control everything with the cyclic; it doesn't work! Once you are moving forwards at 70 knots or so, you can fly the helicopter in a very similar way to a winged aircraft. Settle into a level cruise at about 500 feet above the ground with about 90% torque.

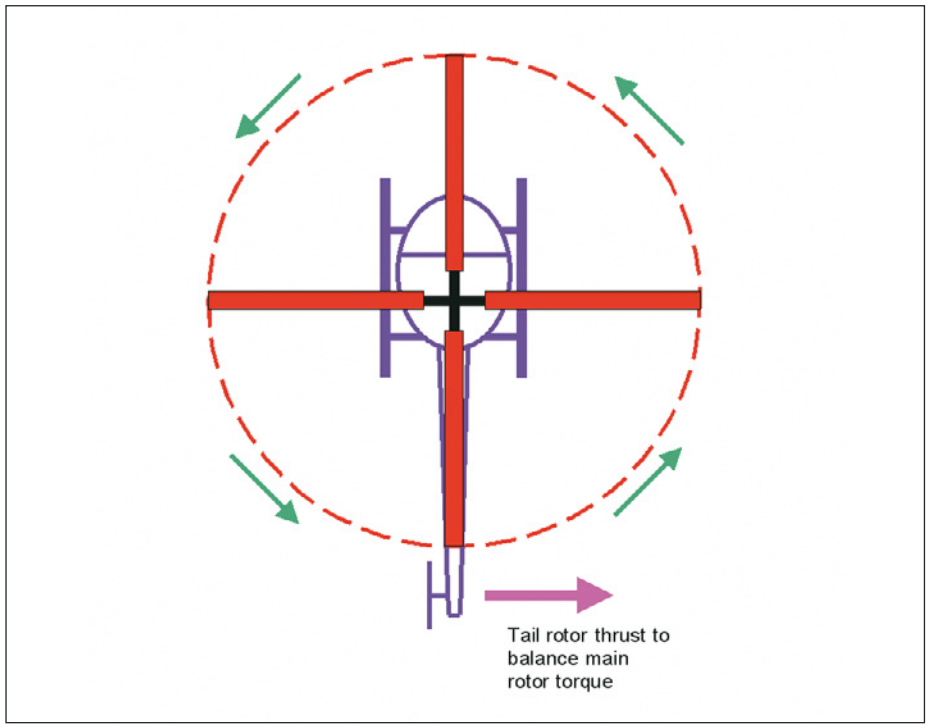


Figure 3. Tail rotor drift is caused by the unbalanced force from the tail rotor. The torque is balanced but the force is not

Now for your landing. Pick your landing spot – ideally a road or a runway, but any reasonable space directly in front of you will do. From your 500-foot cruise, smoothly and fully lower the collective. Keep the helicopter completely level in both roll and pitch. You will begin to descend and lose speed. As you approach the ground, add a fraction of power to reduce your rate of sink; the speed should now be almost zero so, if this is not the case, pull back slightly on the collective. When you are about two feet off the ground, smoothly lower the collective (close the throttle) to firmly plant the helicopter on the ground. This short hop is not very elegant, but as your skill improves you will be able to add more finesse. It may feel as if your ability to hover is improving at a snail's pace, but you will see the benefits to be gained from these short hops.

Hover taxiing

Each stage of learning to fly a helicopter is difficult, and the extension of the low hover to the hover taxi is no exception. Find an airport with an interesting runway and taxiway layout, but without too much scenery so that the frame rates remain high; Edinburgh is a good example. Your task now is to lift off to around six feet and slowly taxi around the runways and taxiways. You'll find that, as you change speed, there will be changes in the amount of lift generated, so you will need to vary the collective. To start moving, you'll need to lower the nose with the cyclic and add some lift with the collective.

Hover taxiing is not as simple as it looks

Once you start to move you will gain more lift and so you'll need to lower the collective again. To slow down and stop, you should raise the nose with the cyclic and progressively add power to avoid sinking into the ground. You'll have to slow down or stop at the turns, so you are practising all the elements of low-speed flight. Try flying some of the taxiways sideways too. Although it's sometimes possible to depart and arrive without using the runway, FS2002 always directs you to a runway, so taxiing is a vital skill to learn.

Take-off and transition into the climb

So far, apart from the short hop exercise, you have been keeping within a few feet of the ground. Transitions are the methods used to change from hovering to forwards cruising flight and back again. Where possible, the take-off begins by building up speed at low level before entering the climb; this is a safety procedure to cover the possibility of an engine failure. If this unthinkable event happens, the helicopter

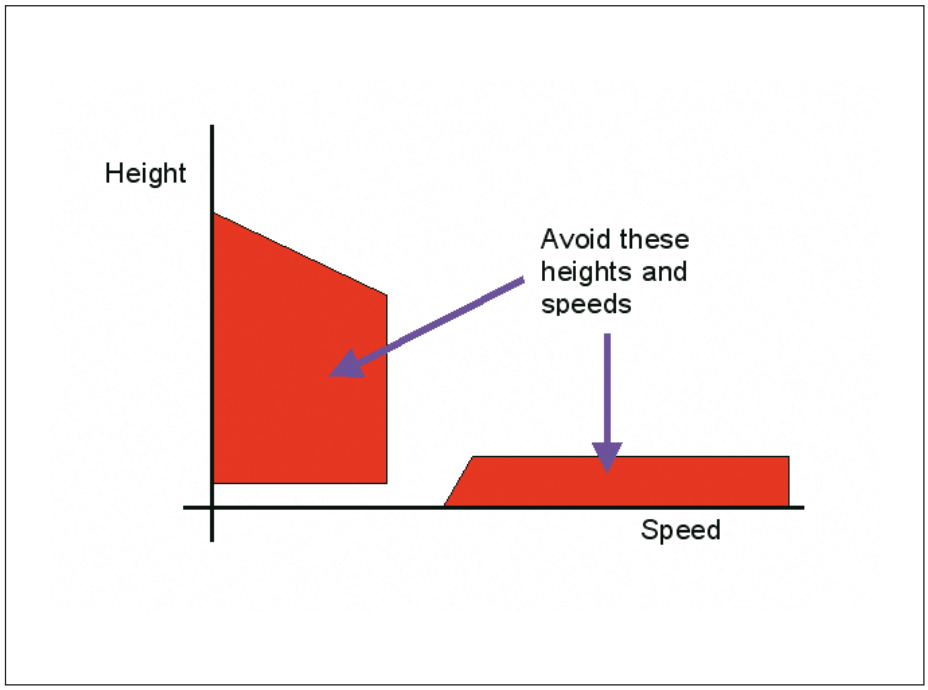


Figure 4. Keep your flying safe by avoiding the red sector

The only way to move forwards is to direct your thrust backwards

This will happen if you don't lower the collective following an engine failure

has to be glided down to a landing. For a helicopter to glide well, it has to have a reasonable forward speed. There is always the option of trading height for speed, but if you don't have enough height this is not possible, hence there is a height below which it is desirable not to hover.

The second issue with engine failures is that, if you are travelling close to the ground, any loss of power will result in a pretty immediate descent and you will not have time to react before you crash. If you are travelling slowly enough, you should survive the impact. To portray this, each helicopter has a height / speed chart in its manual, which looks something like Figure 4.

As a rule of thumb, you should stay close to the ground until you are flying above 30 knots, and then climb away. Also, you should not hover between approximately 15 and 300 feet. Some helicopters have twin engines, even though they only have one main rotor, in which case these criteria can be relaxed.

These constraints dictate the procedure for normal take-off transitions: Start by lifting off into a low hover and then pitch the nose with the cyclic to accelerate forwards, maintaining your heading with the pedals. As you pitch forwards, you will gain some horizontal force but lose some lift, because your main rotor is no longer thrusting vertically (see Figure 5). This causes the helicopter to sink, so you will have to compensate by raising the collective. As your speed increases, an effect called flapback begins to pitch the nose up again. Counteract this movement by easing the cyclic forwards a little further to hold your attitude. At the same time you'll start to gain some lift due to 'transitional lift' and will need to lower the collective to prevent the helicopter climbing. Once your speed is above 30 knots, you should start the climb up to your cruise altitude by both easing back on the cyclic and raising the collective. When you reach the cruise, ease forwards on the cyclic and reduce the collective to hold your height and planned speed.

If you're taking off from a small plot, with trees or buildings all around, you may need to make a towering take-off. The only difference between this and the normal take-off is that you climb to a greater height in the hover before lowering the nose to begin your transition. It isn't ideal, but there will be circumstances where this is the only option.

The cruise

Cruising in a helicopter is very similar to cruising in any vehicle. To accelerate or to go uphill you need more power, and vice versa; to go faster or to climb you must raise the collective, and to descend or slow down, you must lower it. You can always trade some speed against height by, for example, climbing at a lower speed with the same power. An easy way to remember which control to use in the cruise is to use the same one that you would use in an aeroplane. Use the cyclic (joystick) to control the attitude of the helicopter, and hence whether it climbs or descends, and use the collective (i.e. thrust) to control your speed.

The main difference is the instant nature of the relationship between the collective and the rate of climb. Increasing the collective will do little to your speed, but will increase your rate of climb. To compensate, the nose must be lowered in order to hold your cruising height. All the additional lift from the rotor is then being used for changing your airspeed. Similarly, raising the nose will make the helicopter climb, but this will reduce your airspeed unless you add some power using the collective.

Normal landings

Having learnt to hover, your landing will need relatively few new skills. From the cruise, plan your approach to leave you on final approach to the landing spot at about 60 knots. Your approach speed is not critical, but you should hold a relatively steady speed. During the very last stages of your landing run, progressively reduce forward speed and sink rate by gently easing back on the cyclic and raising the collective. Be careful not to lose too much speed too soon, as it is easy to stop moving forwards before you reach the touchdown point. When you finally do reach this point, flare by pulling back on the cyclic to stop any forward motion and by using the collective to hold yourself in a low hover. Then make any necessary small adjustments to your position and lower the collective slightly to place your skids back onto the ground. Ideally start with no wind, then land into wind and finally learn to handle crosswinds.

As you become more skilled at helicopter flying, you will be able to stay at a higher speed until much later on the approach, arrive at the touchdown point at a higher

speed, carry out a big flare and land softly all in one smooth manoeuvre.

Auto-rotation

The possibility of an engine stopping is always a worry for pilots, but just as planes can glide to a safe landing, so can helicopters. In some ways the helicopter is safer, because the final landing in a light aircraft will always be done at a significant forward speed. Following an engine failure in a helicopter, however, it's possible to glide down to a landing with no forward speed. This is good news because it makes the size of field required for the forced landing much smaller.

If you haven't tried gliding in a helicopter before, then now is the time to try it. From a cruise flight at about 2,500 feet, lower the collective completely. Push the cyclic forward to keep a glide speed of about 80 knots. Note how the cyclic and the rudder still control the aircraft. Smoothly increase the collective and raise the nose to regain normal forward flight again. The recovery should be gentle, as there is a risk of entering what is called vortex ring. If you apply too much power when you are descending at a relatively high rate, you will aerodynamically stall the central part of the main rotor, leaving only the tip section of the blades generating lift. The vortex ring is pretty bad news but, as with all aircraft, gentle handling will always help you keep things under control. The handling in auto-rotation after an engine failure is very similar to the handling in a glide, but there are a couple of big differences. Firstly, you have no power available to climb away before hitting the ground, and secondly, you don't know when the failure is going to happen.

The 'practice forced landing' is a vital part of any pilot's training and a flight simulator is the perfect tool for learning the basics. Climb back to a cruising flight at about 2,500 feet; this is a good height from which to practise forced landings, because there's plenty of time before you reach the ground, but not so much that you will have time to relax. The easiest way to achieve an engine failure is to turn off the fuel, by using the switch on the JetRanger panel, for example. When you do this, you will see that the engine (or turbine) RPM needle drops like a stone, but the main rotor RPM needle only drops slowly. Immediately lower the collective fully, and use the cyclic to hold a glide speed of about 80 knots. Notice how the rotor RPM increases again.

You are now in a position to glide the helicopter in the same way you have already practised. Select and aim for your forced landing point, which should be 'into wind', away from towns, buildings, hillsides and forests; if there is an airport nearby, aim to land there. Selecting the landing point is relatively easy in a flight simulator, because the ground is reasonably smooth and generally lacking hedges, walls, animals, rough ground, vehicles or pylons to crash into, but you should try to land within the boundaries of a single field.

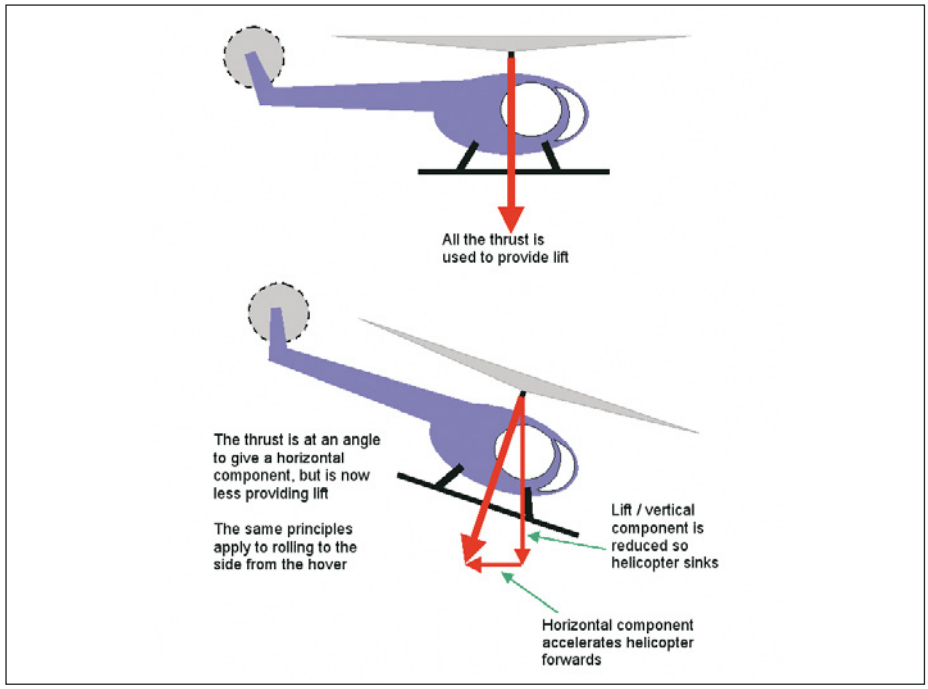

All the thrust is used to provide lift
The thrust is at an angle to give a horizontal component, but is now less providing lift
The same principles apply to rolling to the side from the hover
Lift / vertical component is reduced so helicopter sinks
Horizontal component accelerates helicopter forwards

Figure 5. As soon as the helicopter is pitched or rolled the lift is reduced

Keep gliding until you are close to the ground. As you approach the ground, round out in the same way as you would in an aeroplane. As the nose lifts above the horizon and you near the ground, raise the collective to carry out a normal landing. The inertia in the main rotor will keep it spinning long enough for you to touch down gently, but don't hang around as the rotor will start to slow down as soon as you raise the collective. If everything goes according to plan you will carry out a normal but brisk landing. If you apply the collective too early, the rotor may slow down too much before you reach the ground, giving you neither control nor lift. If you apply the collective too late, you'll hit the ground hard and damage the helicopter.

Once you can auto-rotate to a landing which you'd survive every time, practise by setting random engine failures to occur within the next few minutes. When you have cracked this, set the failures to occur at any time over several hours on all of your future flights (FS2002 will accept up to ten hours). Setting failures to happen at long intervals means that you won't be expecting the failure when it arrives, and also that a failure is unlikely to happen during all your flights. When it does occur, especially if you are concentrating on navigating or talking to air traffic, it will take you by surprise and your reactions may be slower than you would think; once again, this mirrors reality.

Whilst you may want to make all your engine failure landings perfect, in a real helicopter your objective would be to survive and anything else would be a bonus. That's not a bad standard for the simulator pilot to adopt either.

Practice, practice, practice

If you have perfected everything discussed here, you will have mastered the basics of helicopter flying, so fly one as much as you can. You have had the benefit of flying in good weather, but this is a rarity in the real world, so add low visibility and wind as you progress. This will hone your skills, particularly during the hover taxi and landing phases. You would generally aim to land into wind where possible, but you should be able to land with the wind coming from any direction.

As a final set of challenges, taxi to a helipad and hover in very tight circles around it. Firstly, do this keeping the helipad always on one side, flying forwards in tight circles. Then repeat this, but flying backward circles around the helipad. Next, fly round the helipad with it always visible in front of you, so you will be flying sideways circles, and finally fly the same pattern but keep the helicopter pointing in one direction on the compass. Once you have mastered these exercises, fly them as squares instead of circles and, as a final challenge, fly them all again in a light wind.

Learning the basics of flying a helicopter in a good simulation is fantastic value for money – UK prices for hiring a JetRanger with an instructor vary from around £450.00 to £600.00 per hour. Even the diminutive Robinson R22, a common first-level trainer, costs about £230.00 per hour. The cost of your flight simulator, therefore, would get you about five minutes worth of flying time in a JetRanger – just enough time to warm up the engine. ■

Stephen Heyworth

Turret Tactics

We aim not to please (motto of the Air Gunners' Association)

When Combat Flight Simulator 3 arrives later this year, one of the promised features that will single it out from previous versions is some proper bomber simulation. Whether this means that anyone who fancies themselves as Harris, Goering or Eaker can start planning massed raids is not yet clear. We are hoping, however, that we'll have the option to fly as an air gunner, and that CFS3 will join the small number of combat simulations which let you participate from a turret as well as the cockpit.

To prepare ourselves for the opportunity to leap from the pilot's seat to behind the Brownings, we decided to consider some of the historical aspects and the science involved in hitting a moving target from an aeroplane. After a brief look at some of the other simulations to have featured gunnery, we'll take you through some tips to improve your firing abilities in IL-2 Sturmovik.

Air gunnery has been dismissed by many serious fans of combat simulation as nothing more than a glorified arcade game; this is really only the case when the gunner is located at a fixed point in space and the enemy obligingly appears on screen in a position to be shot at. You may have to shoot in front of the other aircraft to allow for some deflection, but it's all quite easy. As with many things, life outside a PC is rather more complicated.

To get an idea of the real thing, get a small camera (without a motor drive), a swivel chair, a racetrack, twelve racing motorcyclists and a flatbed lorry. Screw the swivel chair on the back of the lorry, strap yourself into it and get someone to drive you round the racetrack flat out. Get the motorcycles to ride as fast as they can (which will be a lot quicker than your truck) towards you and sometimes from behind you, both singly and sometimes in groups of more than one. Then try to take some photos of the riders' faces. Not easy, is it? And this is only in two dimensions – imagine what it would be like if they were riding above and beneath you at the same time and your driver was hurling you around when he took evasive action!

You may laugh at the example above, but RAF gunners were in fact trained using targets mounted on a circular railway track, turrets

A B-17 II gunner in action

mounted in the same way (and powered by Ford V8 engines), and also target 'drogues' towed behind other aircraft. USAAF gunners trained using stripped down turrets mounted on the back of flatbed trucks.

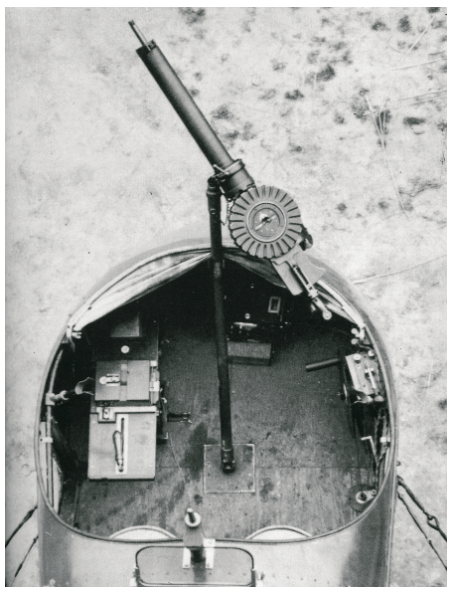
One of the biggest obstacles for a successful air gunner to overcome, apart from being the first thing attacked by any enemy fighter, is getting to grips with relative speed and distance. In the early part of WWI, enterprising pilots and observers began taking rifles into the air in order to take a few potshots at the opposition. Shooting at another aeroplane was not hugely different from firing at a stag or a rocketing pheasant, and so many of the 'gentlemen' airmen of both sides were already familiar with many of the principles of deflection. If a moving object passes in front of you and you aim directly at it and fire, your bullets will hit the space you aimed at. By the time they arrive they will be behind your target and you'll miss. In order to avoid this you need to shoot in front of the target so that your bullets and the hapless quarry arrive in the same place at the same time. The difficult bit is working out exactly how far in front to fire.

It stands to reason that the closer and larger the object, the easier it is to hit. A distant target which is moving fast is very hard to kill with a single rifle bullet – it's almost a matter of luck. Pheasants (and other game birds), however, are quite small and usually very fast, so why do they have such a short lifespan during the hunting season? The answer has more to do with the weapon than the gunner. No one goes pheasant shooting with a .303 rifle – they use a shotgun. It's less accurate and less powerful than a rifle, but the spread of shot means that as long as you fire in the general area of where the bird is flying, you'll be successful. It soon became clear to gunners that a spread of bullets was the answer to hitting other aeroplanes, although you'd need something more substantial than a shotgun pellet to bring down another aircraft. Enter the machine gun.

Putting a machine gun in an aeroplane is not a simple task. Early guns were cumbersome and difficult to reload in a moving aircraft. Enterprising and brave flyers had tried this well before WWI, but with limited success. Machine guns were initially the sole responsibility of the observer, who had his hands free to manhandle them, but enterprising pilots of single-seat aircraft began developing ingenious ways of mounting guns and firing forwards. This meant that there was less need to sight the gun accurately; as long as you could 'aim' the aircraft at the target area, then you could fire.

Various air forces persevered with the technology available and, within a short space of time, fighter aircraft were taking to the skies with twin machine guns firing through the arc of the propeller, while bombers were defending themselves with

Tail-end Charlie in a Lancaster (Imperial war Museum)



An FE gun position. The Poor Bloody Observer had his work cut out! (Imperial War Museum)

How to use the arsenal of guns in an FE2b – note the lack of restraints (Imperial War Museum)

A harrowing image showing the rear turret of a 75 Squadron Stirling after a raid on Duisburg in 1943. 20mm cannon fire sealed the fate of many air gunners (Imperial War Museum)

The Scarff ring on a Bristol F2b – this type of mounting lasted up until WWII

highly manoeuvrable guns manned by dedicated gunners rather than observers.

It's worth noting that by the end of WWI the Handley Page V/1500 bomber was armed with up to five machine guns, and was more than capable of defending itself against attack from other aircraft.

One problem with a machine gun is the rather wasteful way that it expends precious bullets. A standard Lewis .303 would go through a drum of ammunition (47 rounds) in five seconds. Remember this next time you select 'unlimited ammo' in a combat sim. Changing a drum was time consuming and tricky to perform with freezing cold hands, especially in a machine that might be trying to outmanoeuvre an enemy. While fighter pilots were soon equipped with Vickers guns that gobbled up belted ammunition, PBOs (Poor Bloody Observers) had to make do with Lewis guns right up to WWII. They were slowly replaced by the VGO (Vickers Gas Operated) but this still only had a magazine capacity of 100 rounds. During the inter-war period Britain began to adopt the American Browning .303 machine gun; belt fed, it had a number of advantages over the old Vickers and Lewis guns, and by 1941 2,000 a week were being manufactured in Britain. It became the standard defensive armament for RAF bombers throughout WWII.

All gunners need to be able to command the widest possible field of fire, and it stands to reason that their guns need to be as mobile as possible. Early gun mountings consisted of a universal joint fixed to the aircraft and the gunner stood behind it firing forwards. The drawback with this method soon became apparent when the enemy came from behind the gunner. Short of standing outside the aircraft, the gunner could only get a field of fire of about 180 degrees. To solve the problem in 'pusher' aircraft (where the gunner sat at the front and the engine/propeller was behind the wings), they adopted a moveable gun mounting. The gun was mounted on a long leg, fitted to the floor in the middle of the gunner's cockpit, with a universal joint at both ends. To fire backwards, the gunner simply moved around the gun and thus covered another 180 degrees. Alternatively, the base was mounted at the front and another gun was mounted at the back of the cockpit. Leaping around between guns, changing ammunition drums, and trying to remain in the cockpit meant that observers were special people by default!

Once tractor aircraft (observer behind pilot, engine in front) became the norm, the observer, or gunner as he was becoming known, had his gun(s) mounted on a curved metal bar, facing rearwards, that allowed side-to-side movement through about 270 degrees and up-and-down movement via a ratchet. This apparatus was called a Scarff ring and served the RAF right up to WWII.

In the 1930s air gunnery took a huge leap forward as proper gun turrets were developed. Early designs from Boulton Paul were limited in their range of movement and were also cumbersome, but they were power-assisted (using compressed air) and, as the gun was elevated or lowered, the gunner's seat moved up and down to compensate. Eventually, two- and four-gun hydraulic turrets from Fraser Nash, Boulton Paul and Bristol were widely adopted. Gunners sat in a cramped space on a small seat and operated their turret via a set of triggers or a joystick. Solenoid cut-outs were fitted so that you couldn't shoot bits off your own aircraft, although one gunner told us a frightening tale of an air test in a new Blenheim V. Once airborne, it was standard practice for the gunner to test his guns and move them over the field of fire. As he did so he heard a loud bang and the port engine began making some odd noises. It transpired that the solenoids had been wrongly set and he'd just taken the top off the port propeller. Luckily the aircraft made it back, but it's a salutary lesson about not putting one's trust in machinery.

All that remained for the gunner to do was to hit the target, and this was achieved by squinting carefully through the gunsight. Early examples were not much different to

those on a rifle, and these were superseded by the 'ring and bead'. This consisted of a small dot or 'bead' mounted on a pin about 2 inches long at the end of the barrel. At the gunner's end was a large ring made up of quartered concentric circles. By marking the bead against the target and offsetting against the rings he could allow for deflection. As one gunner described it, "..all you did was allow so many rings for the distance between you and the bandit and then let him have it!"

By WWII the reflector gunsight had arrived, and this was a much more sophisticated affair; electrically operated, it showed a green ring of light directly in line with the gunner's eye line. The range was then adjusted using a knob on the sight which automatically adjusted the diameter of the ring, giving you a deflection that depended on the enemy's wingspan. An Me109's wingspan would fill the diameter of the ring at 100 yards. A pair of Brownings gave a cone of fire of about 9 feet at 1,000 yards so, assuming your aircraft recognition was good, you could feel confident of hitting something and gauge the range of your enemy from the size of the ring.

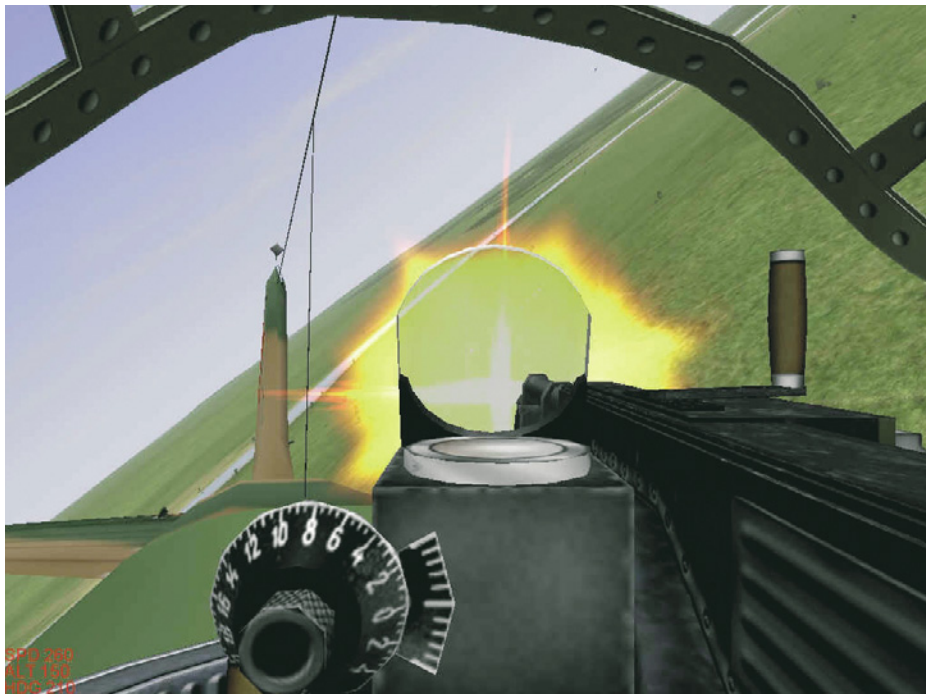
We are now at the point where RAF bombers were armed with belt-fed Browning machine guns, operating from two- and even four-gun, power-operated turrets, and aiming at their enemies through sophisticated gunsights. By 1939 Britain led the world in air gunnery technology, and the inadequacy of single, hand-triggered guns against fighters armed with heavy cannons and multiple guns would soon become apparent when poorly armed He111s came up against Spitfires and Hurricanes.

So, how much of the real practice of air gunnery has been replicated by the builders of flight sims? The first one we thought of was Ubi Soft's IL-2 Sturmovik, where you can hand control of the aircraft over to an AI pilot and man the single machine gun in the rear-facing position. The ring and bead sight is a little rudimentary, but you soon get in the habit of straining your eyes around the sky, searching for telltale specks on the screen that may be the enemy. A couple of minutes in this position with an enemy in the vicinity soon brings home the difficulties encountered by air gunners, and you begin to yearn for four Brownings and some power assistance. Empire's Battle of Britain offers a similar experience, but lacks the excellent effects of IL-2, and the attacking aircraft don't seem quite so aggressive.

Moving on to turrets, we have to mention B-17 II. This was one of the first sims to replicate a proper turret and it's reasonably well executed. You can operate the mid-upper, ball and tail turrets as well as man the waist guns. The operation of the turrets and the sights isn't brilliant, but you do get an idea of the speed of reaction required by a gunner. Finally, the newly released Jane's Attack Squadron gives you the chance to operate a Lancaster mid-upper turret and it comes complete with a reflector gunsight. There's also a Junkers 88, Liberator and B-17 for would-be gunners to choose from and, although the graphics are poor by current standards, the gunnery is probably the best you'll see in the current generation of sims.

It's likely that gunnery in flight simulation will remain something of a sideline to flying fighters and firing ahead, but air gunners were without doubt some of the bravest men around and their role should not be forgotten. There are countless stories of gunners who remained at their posts despite horrific injuries, aircraft that returned intact apart from missing turrets (and gunners), and the effect of an exploding cannon shell from an Fw190 inside the tail turret of a Lancaster doesn't bear thinking about. When CFS3 appears later this year we shall be looking with interest to see if Microsoft can replicate gunnery to the same level of detail as the rest of the air combat experience. ■

Derek Smalls

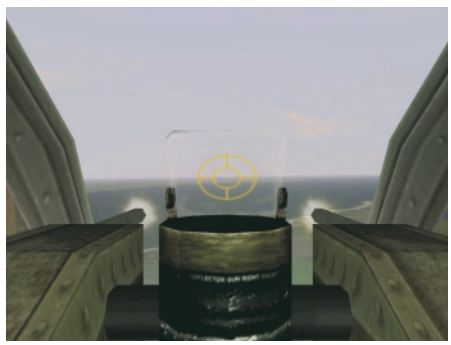


Rudimentary gun and sight, but the IL-2 gunner gets a nice view

A Heinkel gunner in Battle of Britain awaits the onslaught of 'the few'

The Jane's Attack Squadron version of the B-17 turret

The mid-upper turret in B-17 II



The reflector gunsight in Jane's Attack Squadron

Gunnery in IL-2 Sturmovik

Tactics for tail-end Ivan

Air-to-air gunnery often seems like a black art; when you are weaving in and out of the clouds against a pilot who seems impossible to hit, you may feel you need another year of practice! When should you fire? When are cannons most effective? What about convergence? How close should you be before firing? Many readers have written to us expressing their disappointment with some combat sims, because they've flown around for hours on end, fired off thousands of rounds and scored nothing. In an effort to help out, we thought we'd take a look at some of the science.

The latest combat simulations mirror real-world conditions much better than previous ones. It was actually very difficult to get a real air-to-air kill in WWII, and the simulated combat in CFS2 and IL-2 is almost as challenging. Why is it so hard? Firstly, the calibre of the weapons fired is often quite small. Secondly, many pilots fire from too great a range.

"By experience you come to know that when you are a hundred metres from the other machine you are still too far away. The inexperienced pilot breaks away for fear of mid-air collision. The experienced pilot brings his machine in much closer… and when he fires, the other machine goes down." (Erich Hartmann, 352 kills)

Estimating the correct range to the target is the first problem. Then there's deflection, which is considerably more complex, since it depends on your angle off the tail of your target (or AOT for short). We'll consider both these issues as well as convergence settings, but to begin with we'll look at the issue of lethality.

Lethality

Lethality is a combination of four factors: range to target, projectile size, muzzle velocity and rate of fire.

The 20mm M2 cannon can place 196 pounds of lead in the air per minute (weight of fire, or WF), or 50 pounds of lead in the air in fifteen seconds. A .50 calibre M2 machine gun places 20 pounds of lead in the air in fifteen seconds.

It takes an incredible amount of fire from a 12.7mm gun to down an Fw190, and in fact it is rarely done; a 20mm cannon is far more effective. But none of these numbers matter unless you can put that lead on target. Whether a bigger calibre gun is more effective is a moot point. As one air gunner explained, "In daylight, when the range to a target can be greater because you can see the b******s from a long way off (and they can see you), you want 20mm cannons. However, at night, when everything happens at close range, an accurate set of .303 Brownings in a four-gun turret is far superior to a brace of .50s."

Target profile and convergence

Unlike many older sims, IL-2 has no 'hit bubble'. In other words, you can't just hit the general area of your quarry; your bullets must actually strike the modelled object in order to score damage. Furthermore, your bullets will drop with distance, and the profile of the target from the tail is very

The difference 100 metres makes. The target aircraft on the left is 100 metres away and the one on the right is at a distance of 200 metres

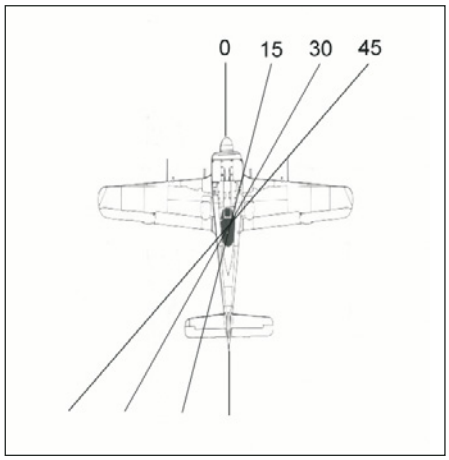
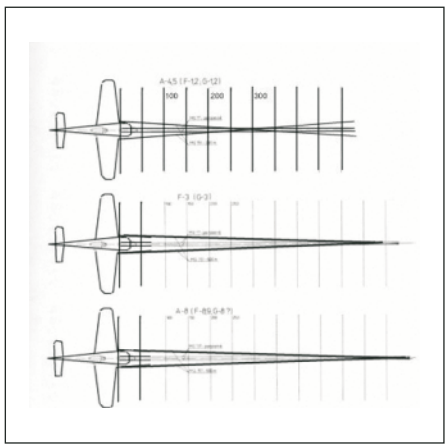


Figure 1. Estimating the AOT



How the guns of an Fw190 converge

small. In IL-2 it is unwise to begin firing at a distance of more than 250 metres. Getting close to the target also raises other issues; the danger of an overshoot rises rapidly, and the amount of time available to actually fire your guns is reduced if your closure rate remains the same. Finally, hanging 150 metres off the tail of a hostile target is extremely difficult.

In IL-2 a straight tracking shot is not a good solution. When attacking from an angle, the profile of the target is much larger, especially the wing profile. Some pilots suggest that the solution is to intercept the enemy by turning inside him to cut off the corner or 'pull lead', but this often results in firing blind. In order to get a deflection shot on a hard turning target, you must place the target well below your gunsight and then guess at the target's heading. We'll consider another option after we look at convergence.

Convergence is the point at which shells fired from guns along a parallel axis meet. While many understand this, not everyone realises that convergence is set in both the vertical and horizontal planes, correcting for gravity. Generally, the setting for guns designed for air-to-air combat is around 200m. The idea is to concentrate a bullet stream on the target at a given distance. This begs the question: At what range will a given projectile have the greatest effect, and how do I know when my target is within a certain range?

Finding the range

The easiest way to determine the range to the target in IL-2 is to select icons ON in the game setup. An icon will then appear near your target, showing the target type and range. This way you can always tell your exact range to the target. Recent changes to IL-2 make it possible to modify the way icons are displayed, as well as when they appear. Check the Readme file that comes with the 1.04 patch for more information. The most realistic method of range-finding is to measure the target against the gun sight.

The Yak 1B has a wingspan of 33 feet, and the gunsight in the Fw190 or Bf109 represents a span of forty feet at 100 metres. As was mentioned in the preceding article, in an RAF reflector gunsight, an Me109 filling the ring diameter meant a range of 100 yards.

Lead angle and turning out of plane

With hit bubbles now consigned to history, the hardest hit to get is one with zero deflection. The pilot is far better off attacking from an AOT of 15˚ to 20˚, whether horizontally or vertically. From any AOT the profile of the target is much larger, and a hit is more likely. Furthermore, targets tend to carry less armour on the underside, which brings us back to the problem of cutting off the corner, which is a necessity in a turning fight. As your enemy turns away from you, the knack is to turn inside him and 'head him off at the pass'. But how do you do it without losing sight of the target? First you have to understand the angles (see Figure 1).

For the purpose of getting a kill, the angles break down into three primary segments: 15˚, 30˚ and 45˚. The angles close to zero are immediately obvious. A 15˚ angle off, and an angle between 30˚ and 45˚ can be seen in the screenshots.

We can use something called the stadiametric principle to calculate a lead angle for a .50 calibre shell with its muzzle velocity of 870 m/s. This results in a solution that shows the lead angle as a function of aircraft size at a given speed. A 5˚ AOT requires half a wingspan lead angle for a hit at 350 knots. A 10˚ AOT requires a one wingspan lead angle at that speed, and a 15˚ AOT requires a one-and-a-half wingspan lead angle for a hit.

When speed is reduced, as in a fight that continues for more than a full circle, lead angle will also be reduced. A 5˚ angle off will require only a one-third wingspan lead, and a 15˚ angle will require one full wingspan. Naturally, this is only a starting point. Experience will temper your aim. ■

Leonard Hjalmarson

Get the right angle!

To help you hone your gunnery skills in IL-2 we've included some lessons and a 'track' file on the cover CD. Open up the folder marked 'IL-2 Gunnery Lessons' and check out the Readme files for instructions.

"A better technique for providing large amounts of lead is to turn slightly out of plane. This should allow the attacker to maintain sight of the target just to one side of the nose. After the range has decreased substantially, the attacker can roll toward the target and pull the sight back to the target's flight path." (R. Shaw, Fighter Combat)

15˚ AOT from above

Angle between 30˚ and 45

There are other angles; learn to work them all

The maths may be difficult, but the result is worth it!

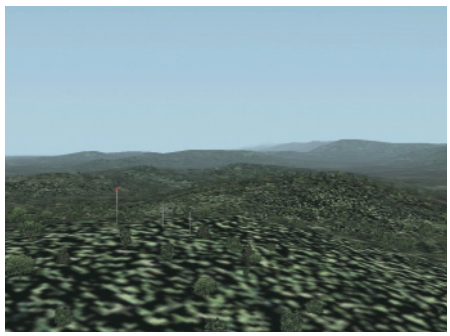
Terrain Mesh Scenery

Untangle the mesh

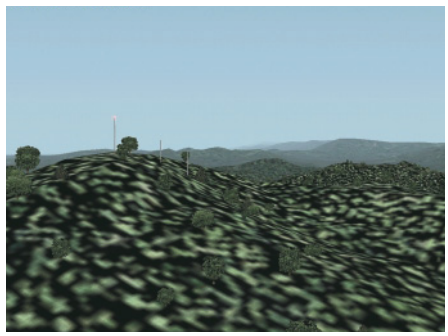
The past few years have seen amazing developments in flight simulation, the most remarkable of which have been in the area of scenery. The flat regions of green for land and blue for sea that once made us gasp with admiration are so far behind us now that it's impossible to remember just how excited we were about those early simulators. Terrain mesh is now the term on everybody's lips, and some stunning scenery has been produced by both amateur and professional developers. The time seems right to find out a little more...

Mesh scenery does not necessarily involve any new textures, buildings or other scenery objects; it is scenery, rather, which represents more accurately than ever before the heights and contours of the real world's terrain. The effects of mesh are not hugely appreciable on flat terrain, thus most of the mesh scenery currently available is of mountains, islands and canyon country. It is very much, as the name suggests, like a fine cloth draped over elevated points to provide a better 3D impression of the landscape. One way to envisage mesh scenery is to think of numerous knitting needles of varying heights stuck vertically into a board, with a textured skin laid on top of them to represent the ground. The closer together the needles, the more accurate the representation.

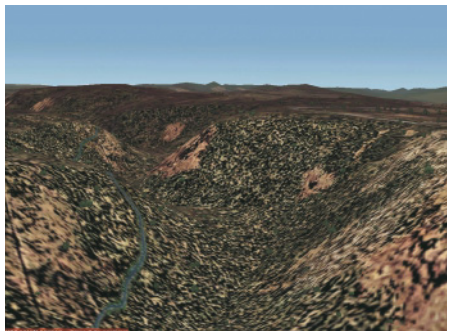
The heights of the needles (or, correctly speaking, the elevation points) at any place on the earth's surface can be provided by satellite mapping information. The space between these points is known as the LOD (Level Of Detail) which, in the default terrain for FS2002, is mostly at LOD=8 in



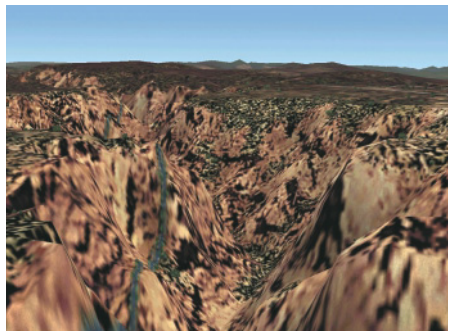
The Appalachians in FS2002. A walk in the park?



A more realistic view courtesy of FSGenesis



The default Black Canyon National Park



A much greater flying challenge from FSGenesis

the United States; this means that the space between these elevation points is 152.9 metres. Outside the US most of the mesh is set at LOD=5 or 6, giving elevation points spaced 1,223 metres and 611.5 metres apart respectively, and is thus considerably less detailed. This probably accounts for our disappointment with FS2002's default representation of the Rock of Gibraltar as a kind of hairy pimple!

Certain areas, such as the Grand Canyon, are presented at LOD=9, which means that the elevation points here are only 76.4 metres apart. Many independent scenery developers, such as FSGenesis, use mesh at LOD=9, and at the time of writing, LOD=10 and LOD=11 are possible, giving elevation points which are only 38.2 or 30 metres apart. The new Monument Valley CD actually goes to an amazing LOD=12, or 9.6 metres between elevation points. The only problem, however, is that as the LOD gets better and the terrain becomes more accurate, the processor power required to make use of this scenery increases. As usual, the enthusiast's computer is constantly chasing the development of increasingly precise representations of the real world. Having said that, the terrain mesh currently available for FS2002 causes little or no decrease in frame rates. One of our test PCs has 256Mb RAM and a 750MHz processor running an ancient Matrox Millennium G400 graphics card, and the scenery caused no problems on a laptop with 256Mb RAM, a 1GHz Pentium and the built-in ATI 4Mb graphics accelerator.

If your sim flying consists of a great deal of low level IFR exercises in cloud, then this type of scenery will undoubtedly provide a more realistic set of dangers, and for VFR mountain flying the sensations will also be enhanced. But because the ground textures and patterns are very often the same as those in non-mesh scenery, the screenshots used to advertise mesh don't appear all that impressive, and it's easy to think that there is very little actual difference. Once you start flying amongst mesh scenery, however, the improvement will be both more apparent and more dramatic.

Independent developers did produce some early mesh scenery for FS98, of which Papa Tango's Austria Professional was probably the most well known. Following that, Switzerland2 from Flight & Cockpit was produced for FS2000, and the terrain in the add-on scenery for Fly! was also very realistic. All these scenery areas still remain impressive.

At present only the US Government is prepared to release high-resolution satellite data of its own territories without charging an arm and a leg for it, so for the moment the rest of the world generally has to make do with less accurate source material. The satellite information used by scenery developers is obtained from the USGS

FSGenesis scenery – Appalachians & Northeast, The Golden State and US National Parks

These three CDs are among the finest mesh scenery currently available for both FS2000 and FS2002, and are part of a larger collection which covers the whole of North America; they are presented at LOD=10, representing 38.2 metres between elevation points.

The Appalachians and Northeast CD covers parts or all of the 17 states in the east and northeast of the United States; if you are careful during installation you will notice a map showing which sections of the US are covered – very helpful to those of us who are not familiar with American geography. Fans of Bill Bryson's travel books will be pleased to know that this scenery area will let you follow the whole of his *A Walk in the Woods* along the Appalachian Trail.

The Golden State covers the whole of California, and the National Parks CD includes all 53 of America's national parks, many of which will be less familiar to many of us than the well known Grand Canyon and Yosemite areas; these are spread all across the continent, so this is a particularly impressive achievement. Nine useful HTML pages provide the latitude and longitude of all the parks, although a larger annotated map would be useful.

Compared with the default FS2002 terrain, the elevation detail is considerably improved by the FSGenesis scenery. While this is apparent in the comparative screenshots on these pages, experiencing the 3D terrain on screen is considerably more exciting than these printed images can show.

Review Score

Publisher: FSGenesis

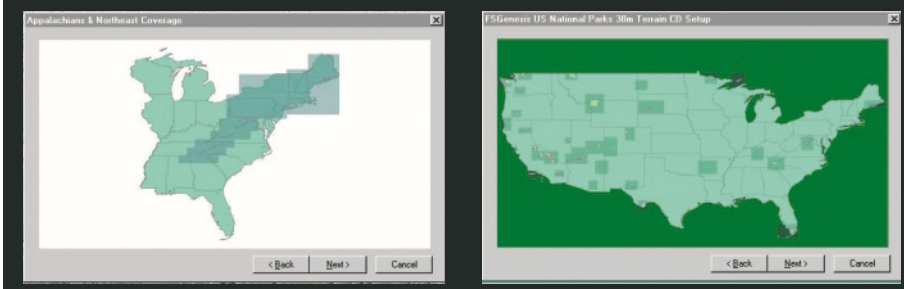
Price: $14.95 (£10.50 approx.) for each CD

Website: www.fsgenesis.com

Developer: FSGenesis

At a glance: "It's a big virtual world, and we've only just begun," say FSGenesis. They've certainly made a great start, and their coverage is constantly expanding.

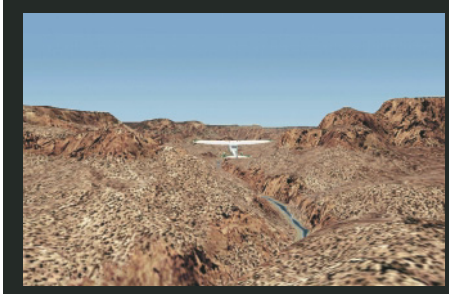
System Requirements: FS2002



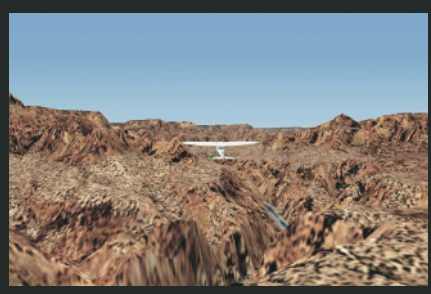
Useful maps show you the exact areas covered by each CD

FS2002 Blue Ridge Mountains looking rather flat

Ridges are actually visible in the FSGenesis scenery



The Grand Canyon by Microsoft



Far grander and better detailed at LOD=9

Mesh on the Web

Terrain mesh developers are currently well represented on the Internet, and many of them are encouraging access to demo sections of their scenery and including useful details of the LOD rating and data sources. There seems to be a healthy sense of competition among designers which, as we know, always results in the enthusiast getting the very best in the long run. Visual Flight, FSGenesis and Gaia are among many who are pushing forward the scenery boundaries, as you can see from the screenshots on these pages. Download their offerings to judge them for yourself.

www.fsgenesis.com

Justin Tyme's website is a good starting point for those who'd like to study the subject in more depth. His Primer and Tutorial pages are informative and clearly written, and will lead you gently into the more technical side of scenery production.

www.visualflight.co.uk

UK and Ireland Terrain Mesh Scenery, which we reviewed in the last issue. The free demo of the Lake District is a dramatic improvement on the default scenery.

www.avsim.com/greece/hvacc/entrance.htm

Impressive new Greek and Cyprus scenery by Babis Perivolas

Further technical information and downloads are available from:

http://fssharecenter.com/fslandclass

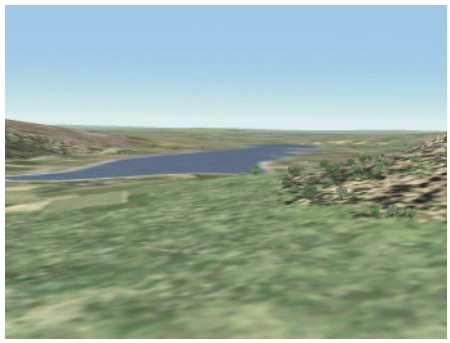
http://fssharecenter.com/fsmesh

www.fsfreeware.com

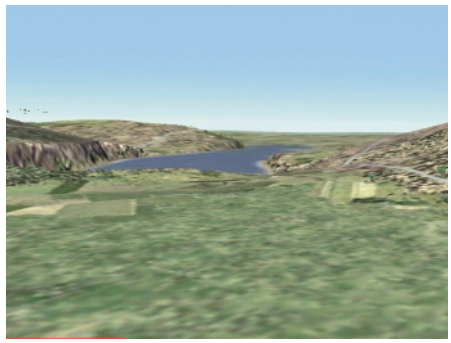
www.scasm.de

Default Hawaii, with the famous Diamond Head crater looking distinctly unimpressive

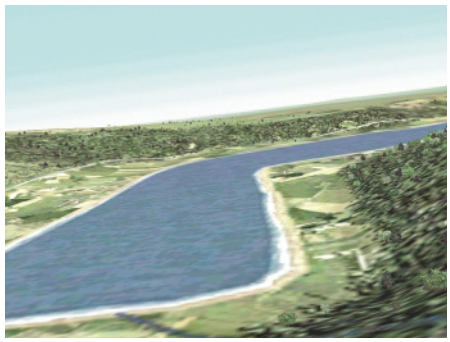
A great improvement from Orlando Sotomayor which also removes the inaccurate buildings



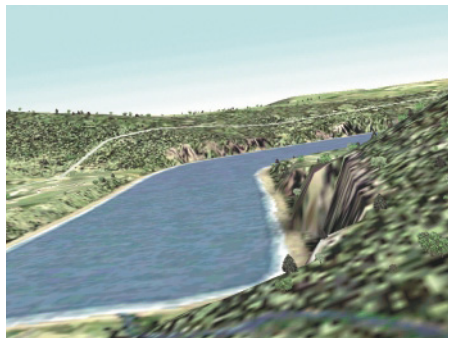
The default Keswick in the Lake District



More contours from Visual Flight



Mardale as provided by Microsoft in FS2002



Much improved cliffs and hills in the Visual Flight mesh

(United States Geological Survey), which has been in existence since 1879 and produces thousands of maps every year containing details of energy resources, floods, earthquakes and so on. One of its products is the DEM (Digital Elevation Model) mapping of vertical positional accuracy, which covers the United States, Hawaii and most of Alaska.

Another frustration for developers of new mesh scenery is that there seem to be restrictions, for the moment, on what kind of textures you are able to use with the height data in FS2002. What is called the Second Element in terrain mesh has just been released, allowing a scenery developer to replace the default textures with others of his own choosing, but the problem is that it is only possible to replace such textures with files which already exist in FS2002. Some scenery designers, such as Gary Summons, are unhappy because so many of the existing textures are too general, and downright inaccurate particularly when it comes to representing Europe. The Corn Belt and prairie land patterns of Idaho, for instance, are hardly appropriate in Yorkshire! So, although we may now have more precisely contoured hills and valleys, we have sometimes literally 'lost ground' in terms of accuracy of visual appearance.

Remember, mesh scenery does not alter the default features in FS2002, and coastlines, rivers, towns and roads, for instance, all remain. As John Farrie of Visual Flight has pointed out, there is a problem with the elevation of many of the lakes in Microsoft's new scenery. FS2002 creates cliffs or embankments around some of these lakes when mesh scenery is installed, and this helps to make them look much more authentic than the default beaches, as you can see in the Lake District screenshots.

A few years ago, in the days of FS98, it was still possible for designers to use their own purpose-made texture files with 'texrelief' scenery. This was very similar to the scenery in FS2002 but, although potentially very exact, it was rather processor-intensive. It was also possible to fly right through it, which caused obvious problems, and consequently developers generally used it only for islands and so forth. Being soft, and subject to 'piercing', the default scenery underneath kept breaking through; some readers may recall this happening with the original Austria Professional.

As always in flight simulation, improvements to all features come thick and fast, often with bewildering speed; it's reassuring to know that developers are constantly striving to improve on all the features currently available to us. Terrain mesh scenery is no exception, and ever increasing levels of detail and realism can only ensure that the virtual world we fly in just keeps getting better and better. ■

Christopher Jarman

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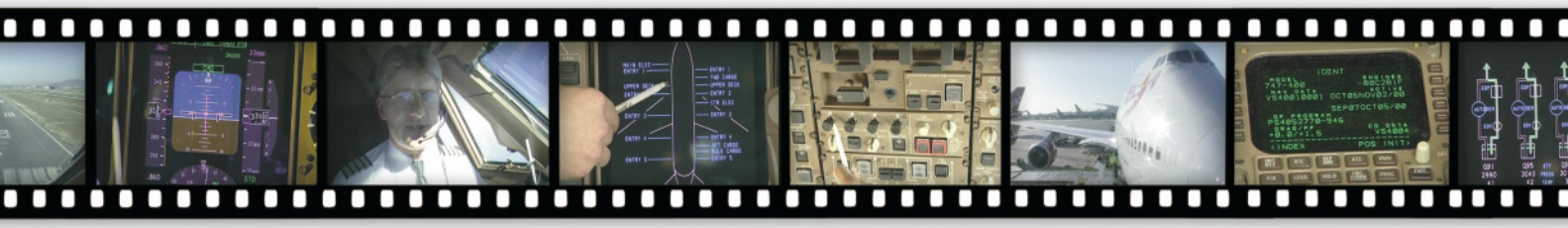

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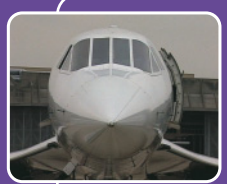

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Just Flight tv

Extending Flight Simulation with gmax

Part One: Installation

FS power tool

gmax genius 1 – DSB Design's gmax reworking of Mikko Maliniemi's BAe Hawk, originally created with FS Design Studio

When we first started to dabble with producing our own video games, the world was a very different place; digital watches were just beginning to forget that their main job was to tell the time, Solo Flight on the Commodore 64 was the flight sim to have, and producing a video game required a team of just one person, usually with no artistic or musical talent. Times change, and many of today's games projects involve a cast of hundreds, a budget of millions and staff with degrees in animation, video editing and audio engineering.

In the quest for ever more lifelike 3D imagery, a number of products sprung up to make the life of the 3D artist easier. Products such as Lightwave, Maya, and 3D Studio Max have become household names among the games community, while the products of companies such as Silicon Graphics have achieved almost legendary status. One company that turned its hand to the wonderful world of 3D graphics was Autodesk, makers of the fabled AutoCAD product. Their 3D Studio Max product is still viewed today as the most cost-effective and powerful solution for games designers looking to produce stunning in-game art and video for the PC platform.

The strength of 3DS, however, was also its biggest weakness. 3DS has an incredibly powerful set of 3D design tools, but its output is aimed squarely at static rendered images and high-quality rendered animations. If you want to produce graphics for in-game use, such as aircraft in FS2002, you have to jump through some hoops to convert the output of 3DS into something the game engine can work with. Kinetix, which now owns the 3DS range, answered this shortcoming with a version of 3DS specifically aimed at producing levels, characters and other 3D objects for use in games, and that product is called gmax.

Gmax is available in two forms; one is aimed at games developers, the other at consumers (that's us, largely speaking), so it's the latter that we are most interested in. Forward-thinking designers such as Microsoft are able to build in support for the free version of gmax into their own simulators and games. They can do this by producing Game Packs that hook into gmax and provide a convenient way of mapping the output of gmax into something the software can use. In the case of FS2002 this means that gmax can be used to create aircraft and scenery, which at last provides us with the power to customise the sim to our particular needs. Got an airfield nearby that's not accurately modelled in FS2002? Just fire up gmax and build the airport yourself. Found a 3D model of a plane that you'd love to fly on the Net? Import it into gmax and output it from there as a FS2002 aircraft. The process is actually a little more complicated than that, but the principles remain the same.

In this article we are going to walk you through getting gmax set up on your system and working with FS2002. Gmax is a huge subject, and quite complex to use, so aircraft and scenery building will be dealt with in our next issue. By the end of this one, though, you'll have gmax installed and working, and you'll know exactly how to make use of the extensive tutorials that come with it to get underway yourself. If you're in any doubt as to what you can do with this powerful program, just take a look at the creations on these pages, all designed by extremely talented authors using gmax.

Good news, bad news, and good news…

The good news is that gmax is actually supplied with the Professional version of FS2002. If you take a look in your FS directory (usually C:\Program Files\Microsoft Games\FS2002) you'll see a small directory named quite simply 'gmax'. The bad news is that you can't use it; in order to use gmax you need to register it on the Internet. Since the release of FS2002, Kinetix has upgraded and extended the features of the free version of gmax, and it's no longer possible to register online the version that comes with FS2002. This, of course, means it's useless, and you'll have to be very interested already to consider downloading the updated version.

The good news is that the folks at Kinetix have kindly allowed us to put the new gmax, including tutorials, on the PC Pilot CD, although you'll still need Internet access to register it. Don't go deleting the gmax directory you've already got in FS2002 just yet, though – the Game Packs that let gmax work with FS2002 are in there, and they'll be needed in setting up the new version.

Installing gmax

Take a look at the 'gmax' directory on the cover CD. You should see four buttons, and click on Install GMAX to start up the installer. The installer is actually a self-extracting Zip, so after a short delay you'll see the familiar WinZip installer dialogue appear, as in Figure 1. Click the Setup button.

The WinZip extractor will start to pull out all the files that make up the real gmax installer, a process that could take some time, depending on the configuration of your machine. When this is complete, the gmax installer should magically appear, looking much like the one in Figure 2. Click on the Next button, accept the usual License message, and click on the Next button to move on.

You'll now see the install directory dialogue (Figure 3). By default, the installer puts the application in C:\gmax; for simplicity's sake, it's a good idea to let it install there. If you do want to choose a different directory, just click the Browse button and choose the location that you prefer. Make a note of this location though – you'll need it when we start to consider the tutorials, Help files and Game Packs later.

Once you have selected the directory that you want, hit the Next button again. The installer will let you know that it's now ready to go ahead and make changes to your system so, providing you are happy with everything, click Next once again. The files for gmax will now be copied onto your system, as in Figure 4. You'll also notice that if you are using Windows XP, that the dialogue can look garbled in places. Don't worry about this at all – everything should still be fine.

You may now be asked if you want to install the Flash 5 add-in. Say Yes if you are asked this question, because it's used by some of the Help and tutorial files, as well as countless websites.

Finally you'll see the dialogue in Figure 5. Click on Finish and you're done. At this point you could run gmax – there will be an icon on your desktop ready for you to click that will do just that. There won't, however, be any Help files or tutorials to help you use the application, and it won't talk to FS2002 at all, so hang in there and keep reading.

The next step is to install the Help files; given the complexity of gmax these are essential. Go back to the gmax page on the CD, and click the GMAX Help Files button. Once again the WinZip self-extractor will pop up. You need to be careful at this point though. Take a look at Figure 6. By default the extractor says that it will place the Help files in the gmax directory. This sounds fine, but it's not. If you were to click Unzip at this point (don't!), the extractor would attempt to create a gmax directory on the CD, and would fail for obvious reasons.

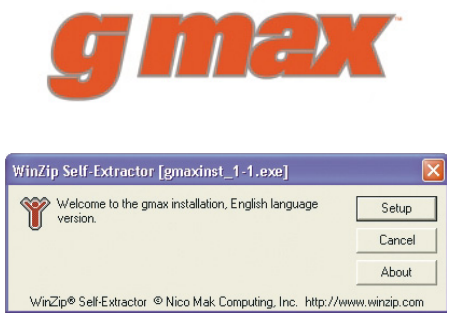


Figure 1

gmax Setup
Welcome to the gmax Installation Wizard
It is strongly recommended that you exit all Windows programs before running this setup program.
Warning: Flash 5.0 or greater needs to be installed for gmax to run properly. The option to install Flash 5.0 will be presented at the end of this install.
Please close any programs you may have running, and click Next to continue the installation.
WARNING: This program is protected by copyright law and international treaties.
Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.
discreet
View Readme
< Back
Next >
Cancel

Figure 2

gmax Setup
Destination Folder
Select a folder where the application will be installed.
discreet
The Wise Installation Wizard will install the files for gmax in the following folder.
To install into a different folder, click the Browse button, and select another folder.
You can choose not to install gmax by clicking Cancel to exit the Wise Installation Wizard.
Destination Folder
C:\gmax\
Browse
Wise Installation Wizard®
< Back
Next >
Cancel

Figure 3

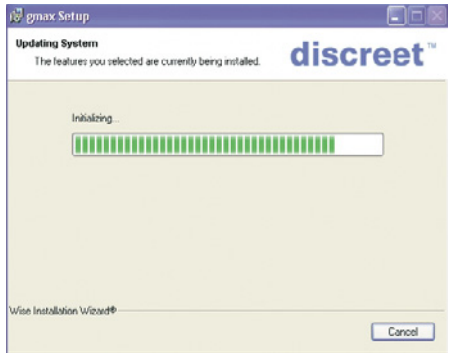


Figure 4

gmax genius 2 – Piper Cherokee Arrow III by Warren Baier

Instead, click in the text box that says gmax and replace it with the proper location for gmax on your system. If you accepted all the defaults when you installed the software a little while ago, you will need to replace gmax with C:\gmax, then click Unzip. The Help files are quite large, so once again be patient as you watch that progress bar edge its way towards completion. When it's done, click the Close button to shut the WinZip extractor down.

Now for the tutorials. Back at the gmax page on the CD, click the GMAX Tutorials button. Once again this will fire up a WinZip extractor, and once again you'll need to replace the name of the destination directory with C:\gmax, or whatever directory you chose to install gmax into.

Finally, you need to install the texture library. For those of you unfamiliar with all the weird 3D jargon out there, a texture is simply a picture that can be attached to something. So, if you have a cube that you've created all by yourself, you can wrap a picture of a concrete slab around the cube (the concrete slab picture is the texture) and you suddenly find yourself looking at a cube of solid rock. You'll need the textures to work through the tutorials and also to give you a head start in creating your own images. Installing them is simple enough and is done in exactly the same way as installing the Help and tutorials. Wander back to the gmax page on the CD, click on the GMAX Library Files button, and away you go. Don't forget, though, to key in C:\gmax (or the name of your chosen directory) as the directory into which to install the textures.

gmax genius 3 – based on Greg Pepper's excellent new gmax Convair 580

Installing the Game Packs

Although we're not going to get a chance to use it until the next issue, we'll install the Flight Sim Game Pack into gmax ready for next time.

First, take a look at your FS directory. If you installed FS2002 in the default directory, this can be found at C:\program files\Microsoft games\fs2002 (Figure 7). Explore into the gmax directory (Figure 8), and within that the Flightsim directory. Installing this lot into gmax is really quite easy; just select the entire contents of the directory and then copy and paste them into your C:\gmax directory. C:\gmax should already include all these files so you will be asked if you want to overwrite them – answer Yes. You're all done. All that remains to do now is register the software, which is a free and painless affair – we're not talking Windows Activation here.

Figure 5

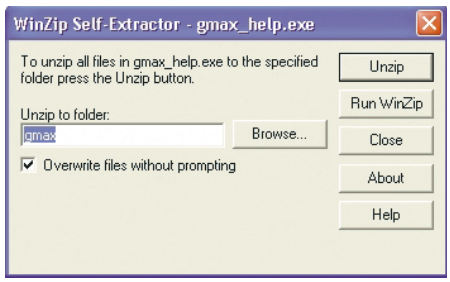


Figure 6

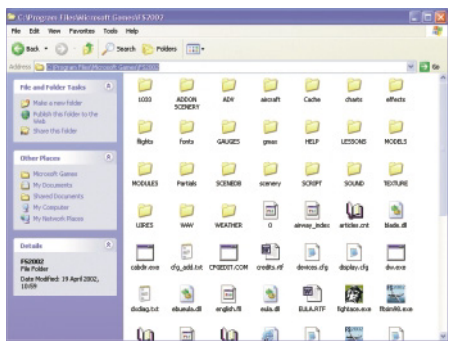


Figure 7

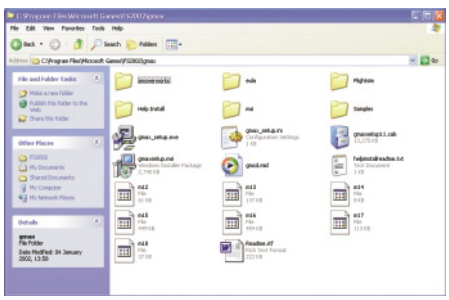


Figure 8

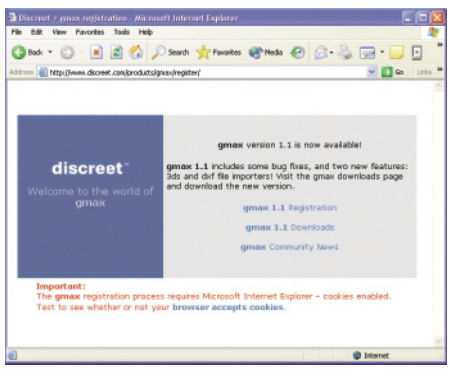


Figure 9

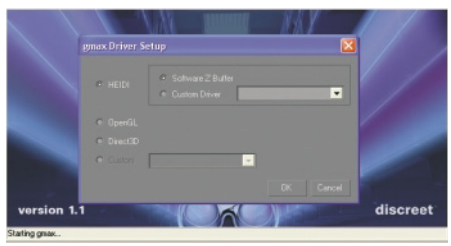


Figure 10

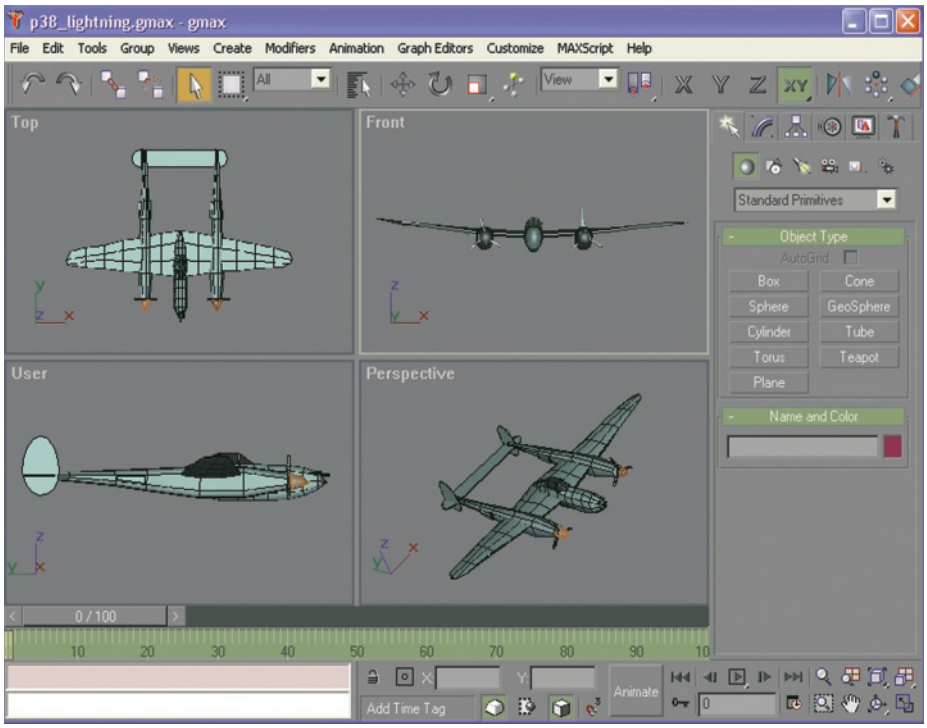


Figure 11

gmax genius 4 – Mikko Maliniemi's Pitts Special

Registration

To start up gmax, just double click on the gmax icon that now lives on your desktop; some whirring of your hard disk will be followed by a message that you need to register. Just click on the URL shown and up will pop Internet Explorer, which will start to download the registration page (Figure 9). Click on the link that says gmax 1.1 Registration, and you'll be taken to the registration form. Simply fill it in and click on the Submit button at the bottom of the page. Run up gmax again.

You'll now be prompted with the confusing looking dialogue in Figure 10. This is simply asking you what software gmax should use to perform all its drawing wizardry. Which you choose is completely a matter of personal choice. The Heidi option will give you a stable display that should work on any video card, while the DirectX option will give you a very fast set of drawing capabilities, but is best used with a powerful video card. Similarly, select OpenGL if your video card supports it – nVidia's for example. When you are done, click on OK. In fact, if this all looks far too confusing, just click on OK and accept the default choice of Heidi.

Introducing the gmax interface

Much whirring of disks will ensue, and you'll end up looking at the gmax interface. For many of you it may well be the most daunting user interface you've ever seen in a computer program. Don't panic. Just like that flight sim that your friends and family all gaze at cross-eyed, it's not as bad as it looks once you get used to it.

Just to check it works, though, click on the File menu and select Open. Navigate your way to the tutorials directory within C:\gmax, and load up the p38 aircraft model. Your view should now look the same as Figure 11.

Exploring some of the features of what this interface has to offer is the focus of the second part of this article, but to get you on your way for now, take a look at the Help menu. There's an entry in there that says Tutorials. Click it. The tutorials that come with gmax are awesome, and will walk you through everything from creating basic shapes to adding animation to them. The aircraft tutorial even shows you how to load up static images and trace around them in gmax to produce a full 3D model of the aircraft of your choice. Explore and have fun. ■

Peter Wright

gmax links

Once you've completed the tutorials you'll no doubt be eager to learn more and get productive with gmax as quickly as possible. There are plenty of resources out there on the Internet to help. First and most important is Discreet's own website at www.discreet.com. Updates to gmax are posted there, as well as news on other gmax-enabled software titles and links to their sites.

Also well worth a look is simviation.com/gmaxindex.htm, which contains a huge amount of information, including some excellent tutorials on adding animated elements,such as landing gear and flaps, to aircraft.

Finally, for models that you can load up and play with within gmax, just go to your preferred search engine and search for 3DS files. Gmax fully supports importing 3D Studio models, so anything free can be used within gmax.

About the author

Peter Wright is the author of ten books on computer programming, and a flight simulation nut. When he's not teaching his one-month-old son Ethan all about DME Arcs he does things with PCs that most of us can only dream about.

Flight Sim Training

Professional instruction with Bill Stack

The charts used in these tutorials have been specially supplied and reproduced with kind permission of Jeppesen GmbH. These charts are NOT to be used for real-world navigation. They are for information ONLY. © 2002 Jeppesen GmbH.

A HIGH AND LONG INSTRUMENT APPROACH

As our tutorials progress, we are applying instrument skills covered in earlier tutorials to increasingly interesting places and unusual situations. In this tutorial we'll combine visual flying skills with instrument skills to provide another unique challenge. In this European flight, we'll leave Munich, Germany (EDDM), under instrument flight rules (IFR), fly over the spectacular Alps in a mixture of instrument and visual conditions, then arrive at Innsbruck, Austria (LOWI), in visual conditions.

Munich is a large commercial airport at the foot of the Alps in southern Germany. Innsbruck is a small but busy airport nestled between two high mountain ranges in the Alps. Much of Innsbruck's air traffic is related to tourism, with airlines bringing tourists in and out of the city, and small carriers operating sightseeing tours and rescue operations.

Pilots arriving at Innsbruck guide their aircraft gingerly between mountains, from above the 9,000-foot peaks surrounding this scenic valley down to the airport's 1,900-foot elevation. We will use an IAP (Instrument Approach Procedure) to ensure that we don't strike any terrain on our way down through this narrow valley.

This IAP at Innsbruck is an offset approach, as was the one we used in Hartford, Connecticut, USA, in Tutorial 10. Consequently, a slight heading change is required during the final approach. The most unusual feature of LOWI's instrument approaches is that the procedure starts at about 7,500 feet (2,288m) above the airport and nearly 20 miles (37km) away from it. Most instrument approaches begin much lower and much closer to an airport.

BEFORE YOU START

A few prudent practices that professionals normally apply can make your flights as realistic as possible. The background will also help you enjoy flying while you learn.

SELECT YOUR AIRCRAFT

Real-world pilots have few, if any, choices in the aircraft they fly. Most general-aviation pilots fly the one aircraft they own. The majority of pilots are rated to fly one aircraft, and only a few are rated to fly two or three. Being free of these physical and legal restrictions, we flight simmers may 'fly' any aircraft available to us in our simulator.

The Mooney Bravo is a suitable aircraft for our tutorials, because it is an easy and fun plane to fly, and it gets us to our destinations fairly quickly. In the Bravo, this 90-mile flight will take about 40 minutes. The IFR version is required, because you will need the ADF that is absent in the VFR version. You're welcome to fly this route in another aircraft type after flying it with us in the Bravo.

THE CHARTS

Be sure to familiarise yourself with the Jeppesen charts we will use for this tutorial before embarking on the flight. They show the flight path, fixes and navigation aids, and are fully explained in the main tutorial. As well as the charts reproduced from the Jeppesen SIMCharts program that you'll see in this tutorial, we've included high-resolution images of the charts on the cover CD. For more information see page 11.

PROFESSIONAL FLIGHT PRACTICES

As usual, we steadfastly emphasise the need for following prudent aviation practices. Applying them or not can make the difference between a successful or a failed flight.

USE FLIGHT PLANS

Flight plans are required for instrument flight, so we always recommend using them for the most realistic flight simulations. You are free to use paper plans or an electronic flight planner. Paper plans are a bit clumsy to make but easier to use aloft. Electronic plans are easy to make, but using them aloft requires following submenus that disrupt the simulation.

In lieu of filing your flight plan with ATC (Air Traffic Control) as real pilots do, imagine that you have filed in accordance with regulations. Keep your flight plan handy throughout the flight so you can easily refer to it. After your flight, file it in a folder or loose-leaf notebook.

NOTE THE TIME

We always jot down the time of significant events during our flights, and we recommend your doing this too. Note the time of take-off, the time of passing significant fixes and navaids, and the time of arriving at the destination airport's airspace. Recording your times and tracking your progress help make the flight more interesting and come in very handy at the destination airport.

COMPENSATE FOR WIND

Be sure to account for winds in your plan, because deviations from your desired course will consume additional fuel and delay your arrival. Our tutorial in Issue 4 explains wind compensation in detail.

MONITOR YOUR PROGRESS AND STATUS

Throughout your flight, check your instruments for the status of your aircraft and engine. Check your position frequently, and also radio navaids, time/speed/heading and/or GPS. Monitor your engine-temperature, oil-pressure, fuel-flow and fuel-supply gauges. Correct as necessary to maintain the desired course, altitude and performance levels. At the end of the flight, compare your estimates to the actual performance in time and fuel consumption.

SIMULATE AIR TRAFFIC CONTROL

We regret being unable to use FS2002's ATC feature in this tutorial; this otherwise good feature has flaws that make it unusable for this flight. It refused to clear us to take off from the runway of our choice, and it repeatedly vectored us off course. Not complying resulted in repeated barking of commands and culminated in termination of our IFR flight plan. These faults occurred every time we flew this route, and we were unable to work around this problem or find any fix for it. We do hope, however, that we'll be able to use this feature in future tutorials. In lieu of ATC, we must imagine that ATC contacts are required at specific times during the flight (as we did before FS2002).

FLY ONE STEP AT A TIME

While leaping over the basics and plunging into advanced flights is a great luxury of flight simulation, it is not realistic. Real pilots do not start at the end of the training course and work backwards, because it deprives them of the skills needed for meeting subsequent challenges. When flight simmers try to meet challenges for which they are unprepared, they frustrate themselves with poor performance and errors. So we strongly advise doing everything one step at a time and building your skills toward the next levels, just as real pilots do. Pause your sim at any time you consider it necessary, as you will not have a certified flight instructor in your cockpit to help you.

USE THESE TUTORIALS FOR FLIGHT SIMMING ONLY

These tutorials are intended for computer flight simulation, not for real-world aviation or real-world flight training. While making our tutorials as realistic as possible, we have adapted them out of necessity to the limits and nuances of flight simulation, so some aspects cannot and do not apply to real-world flight. Therefore we caution everyone to use these tutorials for their intended purposes, and we accept no liability for anybody's misuse of them.

OUR AUTHORS

Bill Stack is an expert flight simmer and author of several popular flight sim books. Nels Anderson, our technical consultant, is a certified pilot and president of FlightSim.com. Learn more about flying like a real pilot from Bill Stack's five flight sim books at www.topskills.com/flitsim.htm.

REFER TO OUR PRIOR TUTORIALS

If you don't have our previous tutorials, they are all available either in back issues or on our 3-in-1 CDs. A complete list of the subjects covered is included on the Cover CD. For more details of back issues and our CDs, see our subscriptions page or the website, www.pcpilot.net.

FLIGHT SETUP

Prepare your simulator for your flight. It takes only a few minutes, and it makes your flight more challenging, more realistic and more fun.

GET YOUR WEATHER BRIEFING

Every VFR and IFR pilot needs to know the weather conditions at origin and destination airports as well as en route. Weather in mountainous regions can vary dramatically from place to place and from moment to moment. Your weather briefing is available from three sources: 1) The weather settings listed in this tutorial, 2) The weather menu you used for establishing the weather for this tutorial, and 3) The ATIS (Automatic Terminal Information System) message at the airports.

Because our IFR tutorials need IMC (Instrument Meteorological Conditions), we'll use them at Munich. We'll deliberately use visual conditions en route and at Innsbruck so we can enjoy the scenery. Oh! The luxuries of flight simulation! Therefore, we'll use local settings for Munich and Innsbruck, and global settings for the en route portion.

When we began writing this tutorial in March 2002, temperatures and weather conditions in Munich and Innsbruck were mild; but temperatures in the higher elevations were cold, so snow still graced the peaks.

Global Weather

Visibility: 10 miles
Wind: 11 knots from 275 degrees
Clouds: Stratus, overcast, Ceiling 2,500 MSL, Top 5,500 MSL
Icing: 'light'
Precipitation: none
Temperature, dew point up to 3,000: 50°F/10°C, 45°F/07°C
Temperature, dew point up to 6,000: 35°F/02°C, 30°F/-01°C
Temperature, dew point up to 9,000: 20°F/-07°C, 15°F/-09°C
Temperature, dew point up to 12,000: 05°F/-15°C, 00°F/-18°C
Pressure: 30.13

Weather at Munich (EDDM)

Use 'Local weather'
Visibility: 5 miles
Wind: 11 knots from 275 degrees
Clouds: Stratus, overcast, Ceiling 2,500 MSL, Top 5,500 MSL
Icing: 'light'
Precipitation: rain
Temperature, dew point up to 3,000: 45°F/07°C, 40°F/05°C
Temperature, dew point up to 6,000: 30°F/-01°C, 25°F/-04°C
Temperature, dew point up to 9,000: 15°F/-09°C, 10°F/-12°C
Pressure: 30.03

Weather at Innsbruck (LOWI)

Use 'Local weather'
Visibility: 10 miles
Wind: 09 knots from 235 degrees
Clouds: Cumulus, scattered 2/8 Ceiling 5,000 MSL, Top 7,000 MSL
Icing: 'light'
Precipitation: none
Temperature, dew point up to 3,000: 55°F/13°C, 40°F/05°C
Temperature, dew point up to 6,000: 40°F/05°C, 25°F/-04°C
Temperature, dew point up to 9,000: 25°F/-04°C, 10°F/-12°C
Pressure: 30.23

Making this flight during daylight or at night is your choice, because there is no practical difference for instrument flights. (Refer to our Issue 6 tutorial for details of night flying.) To make the flight more interesting, try taking off before dusk or dawn so that light conditions will change en route. You will enjoy the Alpine scenery more if you fly in daylight.

PREPARE YOUR AIRCRAFT

Be sure to prepare your aircraft for flight before taking off by setting your radios and gauges and turning on your lights. The following conditions generally apply to most flights.

Two factors must be considered when selecting which runway to use. Because the wind at Munich is from 275, the best runway for take-off would be 26 rather than 08. Runway 26L is a little closer to our destination than 26R, so start your flight at the take-off point of runway 26L.

Calculate your fuel needs and carry enough for this trip, using the aircraft's average fuel-flow rate plus legal requirements to determine the amount of fuel required. Remember that our Mooney Bravo uses about 16.5 gallons of fuel per hour from take-off to landing, and we must include enough to reach an alternate airport and remain aloft for an additional 45 minutes. Our estimate for today's flight is more than 25 gallons and less than 35 gallons. What's your estimate?

SET UP YOUR AIRCRAFT

'Buy' enough fuel based on your fuel calculations. Your fuel mixture should be rich, and your propeller pitch should be low at these low altitudes. The cowl flaps should be fully open while on the ground and during take-off and climbout. The carburettor heat should be off, because it is not needed and its use will reduce performance when the best is needed. The pitot heat won't be needed unless the temperatures are below freezing and there's moisture in the air.

TUNE YOUR RADIOS

Although you can rely on your GPS for navigation, you still need your conventional radio navaids for airport operations, and as a backup during the en route portions. Set your Nav-1 and Nav-2 radios and your OBI for the first frequencies and radials you will use.

SET YOUR GPS

Engage your GPS by displaying it on your screen, then check the displayed course to be sure it reflects your desired flight path. Don't worry about SIDs, STARs or IAPs, because the FS2002 GPS does not reflect them. Set the map for 'north up', 'course up' or 'track up', whichever you prefer.

As usual, pilots should know how to use the GPS devices in their simulators; that is, how to engage the devices, change view screens, select data and so forth. Read your manual for instructions.

SET YOUR GAUGES

As standard procedure, set your altimeter for local barometric pressure.

TURN ON YOUR LIGHTS

Turn on the lights appropriate for this flight. Nothing is wrong with using the position lights and strobes during daylight operations, even though they are required only for night flights. Strobes are required at night except when their reflections from clouds would present a safety hazard to the pilot. Landing lights are recommended for taking off, landing and whenever flying below 10,000 feet (3,050m) above MSL (Mean Sea Level).

PREPARATION CHECKLIST

(This checklist is for these tutorials only, and is not intended to be complete.)

Aircraft Settings

Engine: running
Fuel supply: adequate
Fuel mixture: richest
Propeller pitch: highest
Cowl flaps: open fully
Wing flaps: 10% (specified by Mooney)
Carburettor heat: off
Pitot heat: as needed
Rudder: straight
Ailerons: neutral
Elevator trim: neutral

Gauges

Altimeter: local pressure
Amperes: neutral
Vacuum: green
Oil pressure: green
Fuel pressure: 24 psi (specified by Mooney)

Radios

Com-1: do not use ATC
Com-2: not needed
Nav-1 Primary: 112.3 (Munich MUN)
Nav-1 Standby: 111.1 (Innsbruck OEV)
Nav-2 Primary: 108.6 (Munich DMS)
Nav-2 Standby: 112.3 (Munich MUN)
OBI-1: 145/325
OBI-2: 145/325
ADF: 303 (Rattenberg RTT)

GPS

Map view: ON
Orientation: as desired
Zoom level: as appropriate
Plotted course: as filed
Displayed: as needed

Lights

Beacon: ON
Strobe: ON
Position (navigation): ON
Landing: ON
Taxi: ON

Clock

Local time or your choice

Simulator

Aircraft runs out of fuel

Make a Flight

After you've set up your aircraft, make a flight so you can bypass all these efforts on repeat flights of this tutorial. Name your flight 'Munich EDDM 26L TO Bravo'. In the description box, enter 'Taking off from runway 26L at Munich (EDDM), Germany, for Innsbruck (LOWI), Austria, in the Mooney Bravo for PC Pilot tutorial 17'.

IFR (Instrument Flight Rules) Tutorial Part 17

The High and Long of it – Following a high-altitude approach

Before you begin your flight from Munich to Innsbruck, prepare your simulator and aircraft in accordance with the previous instructions. Then position your aircraft and review your charts.

YOUR FLIGHT CHARTS

Procedures for today's flight are shown on the respective charts.

Airport

With today's northwesterly winds, Munich's two parallel runways, running just about east and west, give us two take-off options: runway 26L or 26R. At 13,123 feet in length each, they're both plenty long enough for our aircraft. Runway 26L is slightly closer to our southerly destination, and it precludes any crossing of other traffic that might be using 26R at the moment. So we'll use 26L.

Departure

The procedure for southerly departures from westerly runways at Munich is shown on the SID (Standard Instrument Departure) chart named 'Munich TULSI'. Of the three options shown, we will use TULSI 6S, which begins at runway 26L and ends at the intersection named TULSI.

The SID for southerly departures from 26L shows two options, depending on the aircraft's ability to meet speed and turn restrictions. The textual description at the bottom of the chart for TULSI 6S calls for proceeding straight out until 1.7 miles from Munich DME (DMS), or when reaching 1,900 feet (580m) above MSL, whichever comes later. Then, aircraft are to turn left and head 180 degrees until they intersect the 145/325 radial of Munich VOR (MUN). This entire turn must be executed within 4.5 miles of DMS. Moreover, the maximum permissible indicated airspeed is 210 knots.

Note 1 states that TULSI 5W must be used if the turn and speed restrictions of TULSI 6S cannot be met. In our Bravo, we should easily meet these requirements; only the largest, fastest and/or heaviest aircraft would be likely to require the alternate procedure.

The difference between Munich VOR and Munich DME is important. Simply stated, a VOR is a radio navaid that provides heading radials and distance readings. They are very common in the United States but not as common in Europe. A DME is a radio navaid that provides distance readings but no radials. They seem to be more common in Europe than in the United States. We've used both types of radio navaids in our prior tutorials. The official abbreviation for Munich VOR is 'MUN', and the official abbreviation for the southern Munich DME that we will use is 'DMS'. (Do not use DMN, which applies to the other runway.)

Once aircraft reach MUN, the procedure calls for heading 181 degrees from MUN to MANAL intersection, which is 17 miles from MUN, then proceeding to TULSI intersection, which is 12 miles from MANAL and 29 miles from MUN. Also, the procedure calls for aircraft to be at 6,000 feet MSL when 13 miles south of MUN and to maintain that altitude until TULSI, where this SID ends.

En route

Paths and fixes between Munich and Innsbruck are shown on the IFR en route chart. There is no airway between the end of the Munich SID (TULSI) and the beginning of the Innsbruck STAR (Standard Terminal Arrival Route), which is Rattenberg NDB (RTT). The Munich SID ends at TULSI, and the Innsbruck STAR begins at MUN. There's an overlap between MUN and TULSI, with both paths appearing on Munich's SID and Innsbruck's STAR. These points are shown on the en route chart, but we will not use an airway between EDDM and LOWI.

Arrival

The arrival procedure for aircraft going to Innsbruck from the north is shown on the Innsbruck STAR chart. This procedure looks more complicated than it is, because it includes arrivals from all directions. Pilots choose the routing that meets their needs. A 17-mile path leads southerly aircraft from TULSI to RTT. Notice that it calls for a minimum altitude of 9,500 feet MSL. This unusually high altitude for a STAR ensures clearance of the Alpine peaks below. Additionally, this is the entry altitude for the instrument approach to runway 26.

Approach

The eastern instrument approach to Innsbruck's runway 26 is shown on the chart named 'Innsbruck LOC DME East'. The abbreviation 'LOC DME' stands for 'localiser' and 'distance measuring equipment' respectively. This approach uses a localiser that's offset five degrees from the runway, similar to the approach we used in Hartford, Connecticut, in tutorial 10. With this runway being 260 degrees and this localiser being 255 degrees, the localiser is angled five degrees to the north. Distance measuring is used not for step-downs or course changes, but for gauging height above the terrain.

The instrument approach procedure for LOWI runway 26 starts at RTT. From there, aircraft fly a few miles heading 211 to intercept the localiser. The chart doesn't specify a distance for this leg, so we'll calculate it from the fixes. RTT is shown as 26 miles from the runway, and the localiser is intercepted 22 miles from the runway. If these points were along a straight line, the distance between them would simply be four miles. Given the angles of these paths, these fixes are probably about five miles apart. This leg will take two or three minutes, depending on your airspeed.

The profile view shows the localiser intercepted 22 miles from the runway, and the glideslope 17 miles from the runway. At four degrees decline, the glideslope is one degree steeper than most glideslopes. Although one degree might not seem like much of a difference, it is also one third steeper. The numerous fixes such as D10.0, D12.0 and D14.0 show the altitudes you should be at when you pass these points. The higher numbers are MSL, and the lower numbers are above the airport's elevation.

Missed approach

As usual, the missed-approach procedure is also shown on the approach chart. This procedure has a series of specific requirements that are not difficult to meet when you know in advance what they are. Therefore you will benefit from reviewing the missed-approach procedure before entering the overall approach procedure. A good time for reviewing this procedure would be during the en route legs between MUN and RTT.

This procedure's three decision heights depend on the aircraft's climb gradient; the steeper the climb gradient, the lower the decision height. The unstated objective seems to be for aircraft to reach an unspecified altitude before turning. We don't think our Bravo will have any trouble meeting any of these climb gradients. The marker beacon is at the last decision point. If you hear the beacon but cannot see the runway, abort the landing and execute the missed approach immediately.

Once aircraft that are aborting their landings reach their respective decision heights, they are to climb at their maximum gradient while continuing on the localiser heading of 255 degrees. On reaching D1.0, which is one mile from the localiser transmitter, aircraft turn left to a heading of 060 with a maximum radius of 0.9 nautical miles. The fine print says that executing this turn at 155 knots and a 25-degree bank will accomplish this tight turn. Then, aircraft fly back to 'AB Lcrt', which is an NDB with a frequency of 313, six miles

east of the runway. From there aircraft continue climbing with maximum gradient on a heading of 075. This course essentially follows the approach course in reverse out of the valley to where the instrument approach began. At D14.0, which is 14 miles from the localiser transmitter, aircraft turn left and head to RTT, which is the initial approach fix for this approach procedure.

Of course, all these steps would be done with ATC's knowledge, who would then direct other aircraft out of your way so that no collisions would occur between the airport and RTT.

PLAN YOUR FLIGHT

Based on these charts, lay out the course you will fly from Munich to Innsbruck. Include the relevant navaids, intersections and fixes shown on these charts. Use traditional paper charts and flight plans or Microsoft's electronic flight planner. Paper charts and flight plans are still useful for seeing our course and estimated times at a glance. The electronic flight planner works with the GPS. If you use GPS, the display will show the course you plotted. You might try the flight once with electronic flight planning and once without for the different experiences.

Enter the following data on your flight plan, whether paper or electronic:

Departure: Munich, Germany (EDDM), runway 26L

Arrival: Innsbruck, Austria (LOWI), runway 26

Waypoint: Munich VOR (MUN)

Waypoint: MANAL intersection

Waypoint: TULSI intersection

Waypoint: Rattenberg NDB (RTT)

Altitude: 9,500 feet (2,898m) MSL

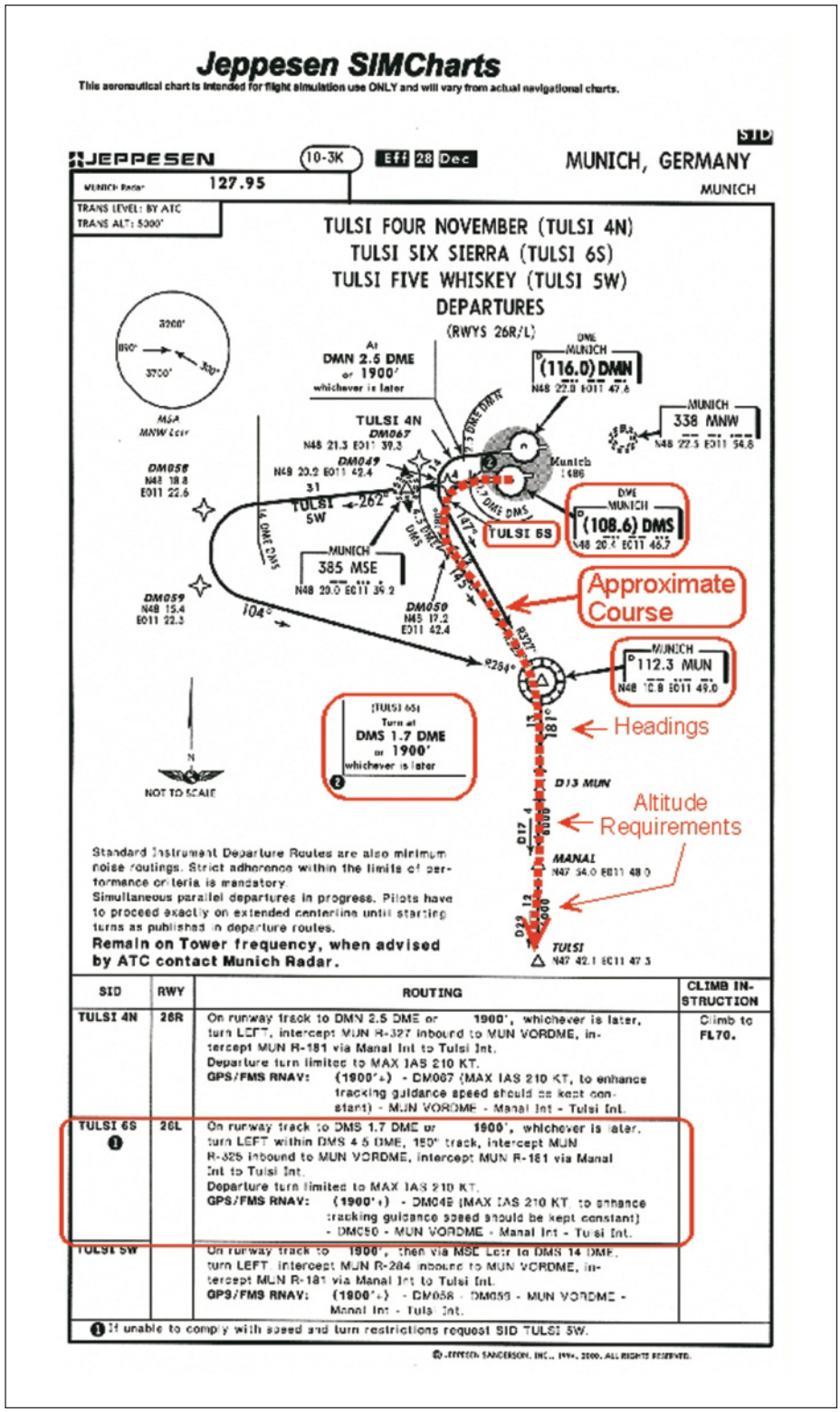
BEGIN YOUR FLIGHT

After you have prepared your aircraft, your cockpit and yourself for this flight, you would contact Munich Ground for take-off clearances. In lieu of ATC services in your sim, imagine that you have requested and received all required clearances.

TAKE OFF

Take-offs would normally begin as soon as ATC clearance is received. Set your transponder for 0367, which is a setting we've received from ATC on other flights. Check your engine instruments during your take-off roll. The Bravo's manifold pressure should be at or above 38, and the oil pressure should be at least 24. The Bravo should lift off at about 60 to 65 knots. If your aircraft isn't performing normally, abort your take-off.

During take-off and climbout on this flight, you will have a headwind combined with a slight crosswind from the left.


Jeppesen SIMCharts
This aeronautical chart is intended for flight simulation use ONLY and will vary from actual navigational charts.
JEPPESEN
10-3K
Eff 28 Dec
MUNICH, GERMANY
127.95
MUNICH
TRANS LEVEL: BY ATC
TRANS ALT: 5000'
TULSI FOUR NOVEMBER (TULSI 4N)
TULSI SIX SIERRA (TULSI 6S)
TULSI FIVE WHISKEY (TULSI 5W)
DEPARTURES
(RWYS 26R/L)
MSA
At DMN 2.5 DME or 1900' whichever is later
MUNICH (116.0) DMN
MUNICH 338 MNW
TULSI 4N
DM067
DM049
DM058
TULSI 5W
TULSI 6S
MUNICH 385 MSE
DM059
DME DMS
Approximate Course
MUNICH 112.3 MUN
Headings
Turn at DMS 1.7 DME or 1900' whichever is later
NOT TO SCALE
D13 MUN
Altitude Requirements
MANAL
TULSI
Standard Instrument Departure Routes are also minimum noise routings. Strict adherence within the limits of performance criteria is mandatory.
Simultaneous parallel departures in progress. Pilots have to proceed exactly on extended centerline until starting turns as published in departure routes.
Remain on Tower frequency, when advised by ATC contact Munich Radar.
SID
RWY
ROUTING
CLIMB INSTRUCTION
TULSI 4N
26R
On runway track to DMN 2.5 DME or 1900', whichever is later, turn LEFT, intercept MUN R-327 inbound to MUN VORDME, intercept MUN R-181 via Manal Int to Tulsi Int.
Departure turn limited to MAX IAS 210 KT.
GPS/FMS RNAV: (1900'+) - DM067 (MAX IAS 210 KT, to enhance tracking guidance speed should be kept constant) - MUN VORDME - Manal Int - Tulsi Int.
Climb to FL70.
TULSI 6S
26L
On runway track to DMS 1.7 DME or 1900', whichever is later, turn LEFT within DMS 4.5 DME, 150° track, intercept MUN R-325 inbound to MUN VORDME, intercept MUN R-181 via Manal Int to Tulsi Int.
Departure turn limited to MAX IAS 210 KT.
GPS/FMS RNAV: (1900'+) - DM049 (MAX IAS 210 KT, to enhance tracking guidance speed should be kept constant) - DM059 - MUN VORDME - Manal Int - Tulsi Int.
TULSI 5W
On runway track to 1900', then via MSE Localiser to DMS 14 DME, turn LEFT, intercept MUN R-284 inbound to MUN VORDME, intercept MUN R-181 via Manal Int to Tulsi Int.
GPS/FMS RNAV: (1900'+) - DM058 - DM059 - MUN VORDME - Manal Int - Tulsi Int.
1 If unable to comply with speed and turn restrictions request SID TULSI 5W.

Munich TULSI SID

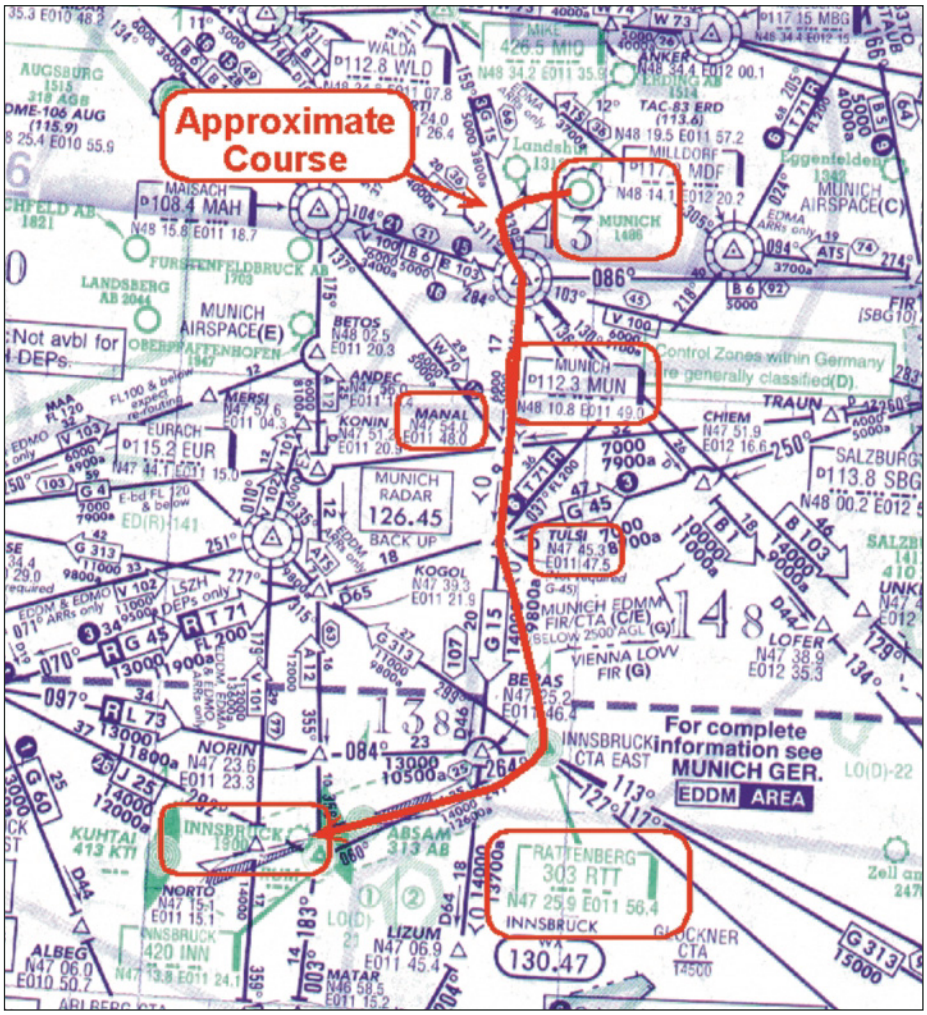
Adjust your pitch to maintain about 85 knots during your climbout. As you are climbing, adjust your cowl flap to keep your engine temperature in the green range – neither too hot nor too cool.

After your initial climbout, your Bravo should be able to climb easily at 700 feet per minute and 120 knots. Retract your flaps when your airspeed reaches 90 knots.

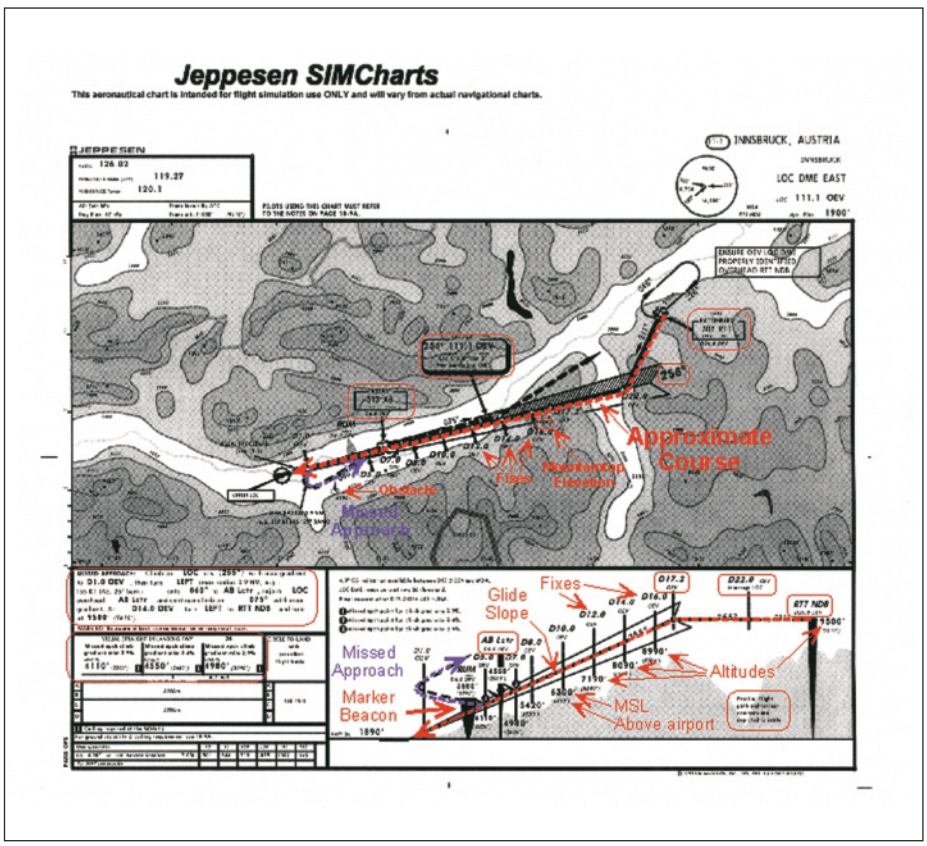
Icing is likely in this wet weather and at these high altitudes. With your aircraft being vulnerable to icing as you fly through clouds during this flight, turn on the de-icers and pitot heat whenever flying through clouds.

DEPART MUNICH

We'll reach 1,900 MSL long before reaching D1.7 DMS, so we'll continue climbing on our heading until we reach this fix. After changing heading to follow our chosen course, you will have a crosswind from the right pushing you towards the left. This first



Munich to Innsbruck (EDDM-LOWI) en route chart



Innsbruck LOC DME East

leg between the airport and MUN is shown as 12 miles, so we should reach MUN about five or six minutes after taking off, depending on our airspeed. This is not an instruction, but only a guide to let you know how much time will elapse.

FLY EN ROUTE TOWARDS INNSBRUCK

Our en route portion will actually be legs of the Munich SID and the Innsbruck STAR, with no en route legs inbetween. For a 'cruising' altitude on this short flight, we'll use the minimums shown on the Munich SID and the Innsbruck STAR.

Notice that we cannot meet prescribed altitude requirements absolutely. The SID says we're to be at 6,000 MSL when we reach D13 MUN, which is a point 13 miles south of MUN, then maintain that altitude until TULSI. The STAR says we're to be at 9,500 MSL when we pass TULSI. We obviously cannot climb 3,500 feet instantly. This conflict arises because these procedures were designed to serve the needs of each airport, not the needs of aircraft travelling between them, so we are forced to make some adjustments. We'll climb, therefore, from 6,000 MSL to 9,500 MSL on that 12-mile leg between MANAL and TULSI. We should reach TULSI 11 or 12 minutes after taking off, depending on our airspeed.

Remember from previous flights that your engine will behave differently at various altitudes. The higher it gets, the less oxygen it will have for combustion, so you will need to adjust the fuel/air mixture to compensate; otherwise the engine will not perform well at all. The engine is performing best when the TIT (Turbine Inlet Temperature) gauge reads between 1,600 and 1,700, so adjust the mixture so the TIT is within this range. Do not exceed 1,750.

Conserve fuel by changing the propeller pitch at higher altitudes. Our Bravo cruised easily at 170 knots and used 15.50 gallons of fuel per hour with the following engine settings: RPM 2,100, manifold pressure 34, and TIT 1,600. If your engine is using fuel too fast, you could run out of fuel short of your destination. Adjust your settings until your airspeed and fuel-flow rates are optimised.

Paying attention to your progress and status is always important regardless of the flight's length. You can easily pass important waypoints if you are distracted.

The ten-minute duration of these en route legs is an ideal opportunity to review the approach and missed-approach procedures.

JOIN THE INNSBRUCK ARRIVAL

The Innsbruck STAR for aircraft arriving from the north is merely two legs that lead aircraft from MUN to TULSI to RTT. When you arrive at TULSI, turn left 22 degrees, head 158 degrees toward RTT, and maintain your

9,500-foot MSL altitude. Because RTT is an NDB, you'll need to use your ADF to guide you there. Depending on your airspeed, you will arrive at RTT about six minutes after passing TULSI.

You need not bother with the holding pattern at RTT unless you want to. Holding at RTT is not a required procedure. ATC will use this holding pattern to hold aircraft, if necessary, to maintain separation on the approach. For the thrill of holding and a taste of true realism, you might fly the pattern once or twice before entering the approach procedure. The choice is yours.

JOIN INNSBRUCK'S INSTRUMENT APPROACH PROCEDURE

The flight path and altitudes prescribed on the approach chart must be strictly followed. The plan view shows the approach path surrounded by high mountains, and the profile view shows how the glideslope keeps you above the mountain peaks along the approach path. As you fly this approach, you will see the hazards for yourself out of your windows. The mountains are so close that you feel as though you could literally reach out the window and grab leaves off the tree tops. We are using visual weather conditions for this tutorial to demonstrate this hazard. After you've flown the course visually, you are welcome to fly it under instrument meteorological conditions for another challenge.

When you arrive at RTT, exit the STAR and join the instrument approach procedure for runway 26, by turning right 53 degrees, heading 211, then intercepting the localiser beacon. Also, reduce your airspeed to 120 knots, and be sure to maintain your 9,500-foot altitude.

During the short leg between RTT and the localiser, change your radio frequencies for the navaids you will use on the approach. Switch your Nav-1 radio to 111.1 for the OEV localiser, and move the CDI (Course Deviation Indicator) needle on your OBI-1 to 255 degrees for the heading of the localiser beacon. Switch your ADF to 313 for AB, which is in the approach path six miles from the runway. It should be straight ahead of you during your descent along the localiser path until you reach it, then it should be directly behind you. You will also need this NDB if you execute the missed approach.

As soon as your CDI begins moving towards the centre, turn right 44 degrees and join the localiser. You should be at D22, or 22 miles to the runway threshold. As with any other localiser, adjust your heading as necessary to align with and follow it. Maintain your 9,500-foot altitude. If you look out of your left front window, you will see a mountain peak right there, replete with trees that taunt us.

Mooney Bravo descends between Alpine ranges on approach to Innsbruck

When you reach D17.2, or 17.2 miles to the runway threshold, begin your descent. Do this whether or not the glideslope indicator is displayed on your instrument. If it is displayed, it should be right on the mark when you're at 9,500 MSL and at D17.2. From here the descent to the runway takes about 11 minutes.

You will notice the steeper glideslope as you descend, because you will glide with little or no power and still have good airspeed. Adjust your airspeed as needed to maintain your glide.

Alpine peaks loom right outside the cockpit

Winds near mountainous terrain are normally erratic in speed and direction. They swirl over the peaks, around the cliffs and ravines, and down the slopes. With mountains on both sides of this approach path, this ride is likely to be choppy on most days. We didn't suggest this level of realism, so you are welcome to program turbulence in this area for more excitement on future flights of this tutorial.

Check your altitudes as you pass charted fixes, to be sure you are clearing the mountains. For example, you should be no lower than 7,190 MSL when you pass D12.0 OEV. If you follow your glideslope indicator precisely, you will have no problems, but checking altitudes and fixes is an additional precaution during such an unusual descent.

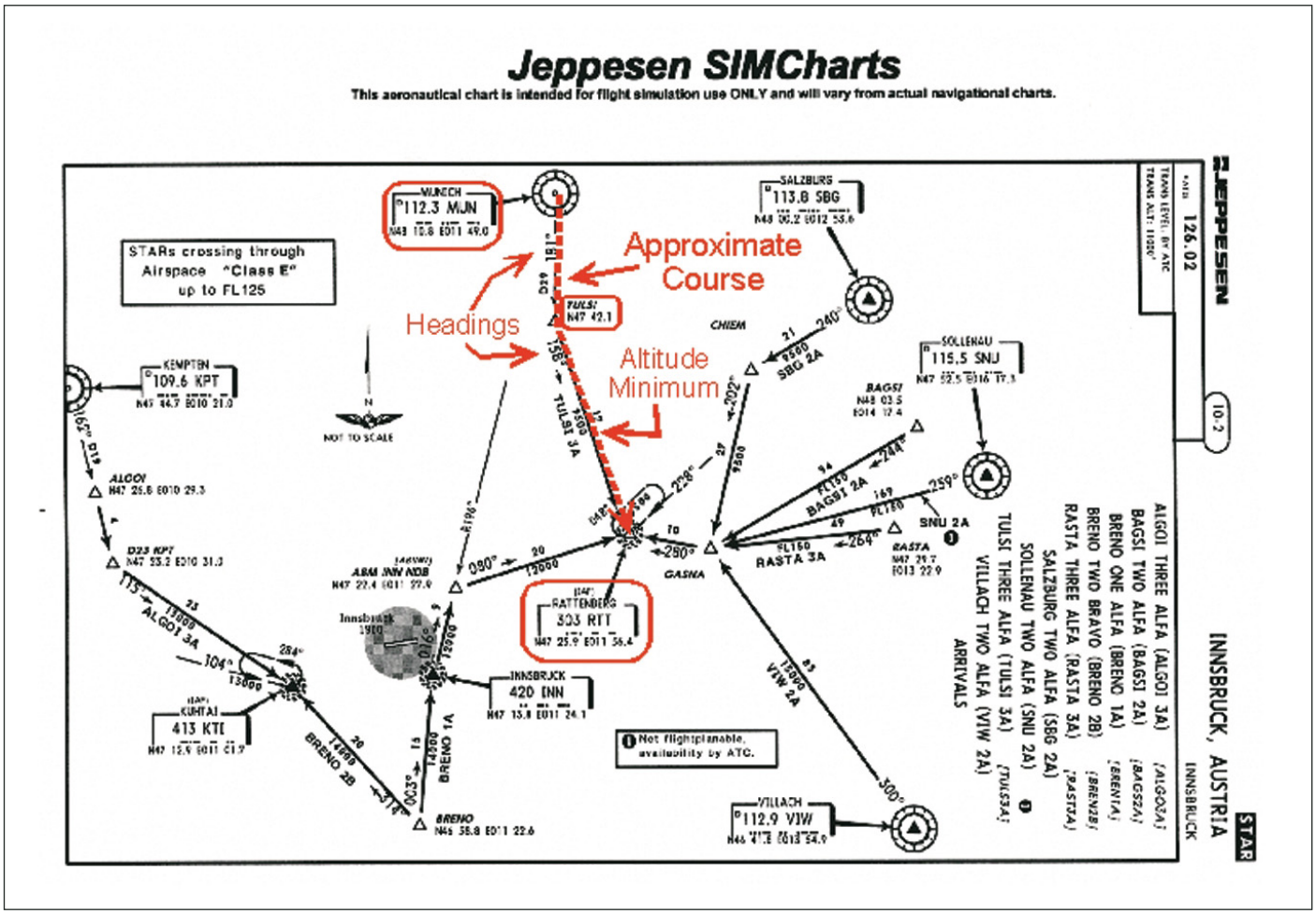
With our visual conditions, you will see the runway long before reaching any of the three decision points. You will also see the runway pointing toward the right instead of straight ahead as you get closer to it. Don't turn toward the runway just because you can see it; your turn should be executed when you are near the runway centre line.

We recommend lowering your landing gear and deflecting your flaps well before turning right to join the runway centre line. One or two miles from the runway threshold per your DME should be adequate. Reduce your airspeed to 100 knots.

When you get close to the runway centre line and feel comfortable about turning towards the runway, execute that five-degree turn and align with the runway centre line for your final approach.

You'll find that switching to the full-window forward view (removing the instrument panel) will enable you to see the visual cues needed for the remainder of this approach. In a real aircraft, pilots can stretch upwards enough to look over the top of their instrument panel and see what lies ahead.

The rest of this approach is a standard visual final approach and landing, so execute them as usual. In today's weather, you will have a headwind with a slight left crosswind factor that will push you slightly towards the right, so hold that runway centre line throughout the final approach and landing.



Innsbruck STAR

MISSED APPROACH?

In the visual conditions we selected for this approach, a missed approach does not apply. Pilots who cannot align a runway centre line for a safe landing under visual conditions execute go-arounds. But, with this airport being so closely surrounded by high and steep mountains, misjudging speed and distance and/or executing the turns improperly could lead to disaster in these confines. With this being your first flight into this airport, misjudgments are likely. Therefore, we recommend that aircraft aborting their landings follow the missed-approach procedure for safety, regardless of the visibility. You cannot go wrong by following the missed-approach procedure here.

Be sure to follow every requirement of the missed-approach procedure. If you familiarised yourself with it during your en route legs, as we suggested, you will find that executing it will not be difficult, although it will keep you busy and attentive. One way of meeting the strict turn requirement would be to follow the parenthetical instruction that says to execute this turn at 155 knots and a 25-degree bank. When you get back at the IAP, fly the holding pattern at least once, then follow the approach procedure back to the airport.

CONGRATULATIONS

You have successfully flown to one of the world's premier mountain ranges, then followed an unusual descent procedure through a famous and beautiful valley to a splendid city with a uniquely busy and interesting airport. Well done, indeed!

Keep flying this tutorial to build your proficiency. Apply stronger winds and turbulence and advance to more sophisticated aircraft to make it more challenging if you like. See you next time. ■

Bill Stack

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Thrustmaster HOTAS Cougar

Hands-on? You won't want to take them off!

The closer you look, the more impressive it gets

In 1993 and 1994 Thrustmaster released their F22 Pro and TQS, the ultimate programmable HOTAS (Hands-On Throttle And Stick); after three years of design and development, the successors to the legendary duo are now available. The Cougar, a replica of the USAF's F-16 stick, is an item of real beauty – it's fully USB-connected, bristles with switches, wheels and buttons, and will let you program a vast array of avionics and weapons functions to the throttle and joystick. Furthermore, the throttle sports a true microstick, which is also fully programmable.

The weight of the box tells you immediately that this is no ordinary flight controller. Both the throttle and joystick are made of metal, as are the knobs and wheels, and the whole ensemble weighs in at a heavyweight 18 pounds. The first thing that strikes you is that the units are immaculately constructed and finished; there are no rough edges or paint chips, there's an unmistakable look and feel of real quality about the whole package, and the metal-to-metal joints are beautifully flush.

Installation is swift and simple; the software is included on CD, so simply follow the Install menu and away you go. After installing the software just connect the throttle to the stick and plug the combined unit into a free USB port. We also plugged our CH Products Pro Pedals into the Cougar prior to connection, and the additional axes were found and displayed in the Cougar's control panel.

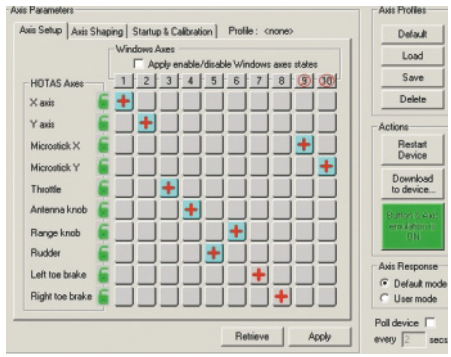
Windows identifies seven axes and 28 buttons, and calibration is automatic; the included Foxy programming software is powerful and flexible. As for future-proofing – which is bound to be an issue with an item as expensive as this – the stick handle can be removed, and Thrustmaster plan to release additional handles, which are likely to be modelled after the F-18, the Eurofighter, and perhaps the MiG-29.

It's immediately apparent that the Cougar is superior in every way to Thrustmaster's previous best, and this new hardware is clearly more responsive and far more programmable than its predecessors. The simplest use of the Cougar is as a Windows device, with all buttons and axes recognised as DirectX 8 devices, but programmability options are limitless thanks to the Foxy software. This allows you to create files which assign your own particular control choices to any simulator, and these can then be loaded into the HOTAS.

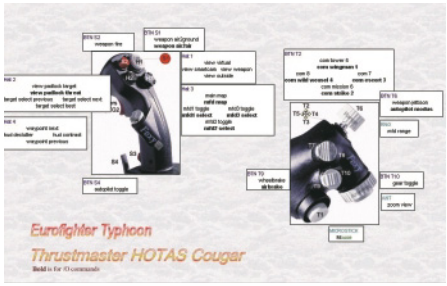
Flying the Cougar

On the stick you'll find four four-way hat switches, programmable in nine positions, three buttons, a two-stage trigger and a lever. The throttle provides two rotaries (both with centre detents, one of which incorporates a click switch), a four-way Radio switch, a three-way Dogfight switch, a two-way Speed Brake switch, and a true microstick.

The feel of these controls during flight is very different from the older gear. The switches feel more solid; every click on a switch is much firmer, and response to a button or wheel movement is instant. Both units are very comfortable to grip, feedback is good, and the actual strength needed to deflect the stick to the end of its axes is slightly less than with the F22 Pro, or considerably greater than a CH Products stick. One of our number who had



Axis parameters in the control panel



Foxy's Eurofighter Typhoon configuration

previously flown only with Microsoft's Sidewinder Pro found the 18lb spring strength of the Cougar quite demanding, even going so far as to complain that he would have to start weight training! The throttle arc remains the same as on the ThrustMaster TQS, but the detents require a little more force to pass over. The detent position can be adjusted by taking the unit apart.

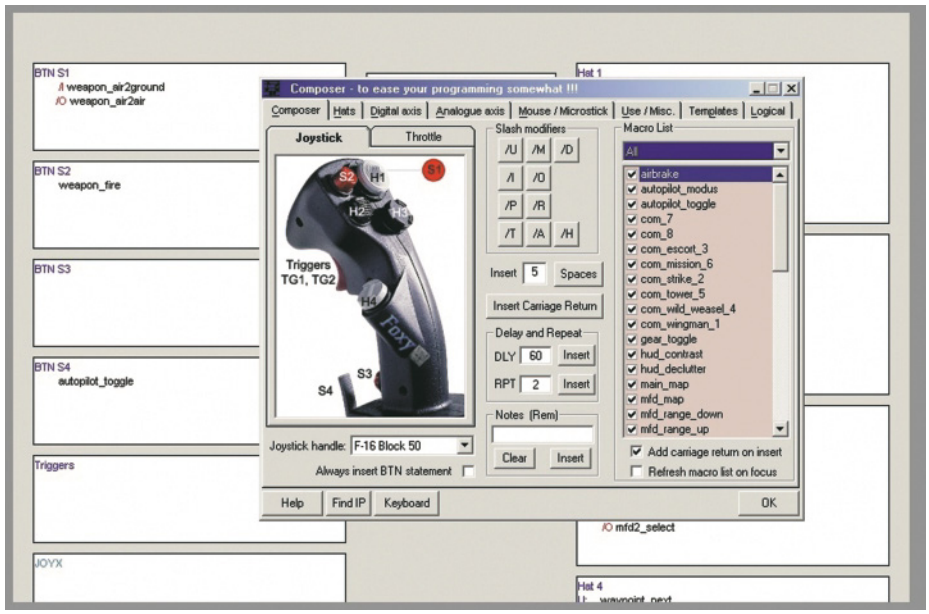
We tested the Cougar in a wide variety of sims – some of the latest, and some old favourites. The first flights were rather short, as the increased sensitivity of the unit had us bouncing around the sky like novices. The Cougar was more sensitive than our CH Products Flightstick and, with 3,000 read points on the X and Y axis, very fine control is possible.

Once the response curve had been scaled, and the stick was responding according to our preference, flying with these units was the best experience we have ever had with a HOTAS. The ability to customise configurations, so that flaps, for example, are always found on the same hat or switch, reduces the learning curve when moving between simulations. We experimented with programming some alternate response curves to the Range wheel, which lets you move from one response curve on the axis to another by simply moving the Range wheel during flight. The throttle is similarly programmable. While the flexibility is astounding, the trade-off is complexity. It's possible to use simple assignments and download pre-programmed files for any simulation, or you can customise to your heart's content. The included 200-page manual offers detailed instructions on every area of programming and functioning.

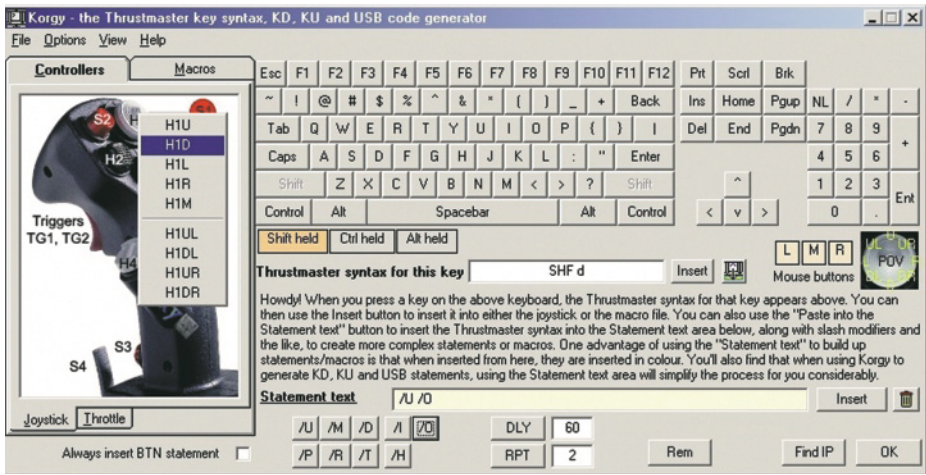
The microstick is a unique twist; think of it as a programmable trackball that you control with your thumb. Ideal for panning the view internally or externally, it can also generate a mouse click when depressed.

Programming

Programming the units can be as simple as loading a configuration file in Foxy and then downloading to the Cougar. Configurations can also be viewed in a schematic layout using Quick View. Building a custom configuration requires the Foxy suite, where you are taken through the stages one step at a time with a graphical interface.



The Foxy Composer – you really are spoilt for choice


Korgy - the Thrustmaster key syntax, KD, KU and USB code generator
File
Options
View
Help
Controllers
Macros
Triggers TG1, TG2
Joystick
Throttle
Thrustmaster syntax for this key
SHF d
Insert
Mouse buttons
Howdy! When you press a key on the above keyboard, the Thrustmaster syntax for that key appears above. You can then use the Insert button to insert it into either the joystick or the macro file. You can also use the "Paste into the Statement text" button to insert the Thrustmaster syntax into the Statement text area below, along with slash modifiers and the like, to create more complex statements or macros. One advantage of using the "Statement text" to build up statements/macros is that when inserted from here, they are inserted in colour. You'll also find that when using Korgy to generate KD, KU and USB statements, using the Statement text area will simplify the process for you considerably.
Statement text
/U /D
Always insert BTN statement
DLY
60
RPT
2
Rem
Find IP
OK

Korgy – complicated, but infinitely flexible

Foxy can also be used to move between Windows and programmed modes, or to recalibrate the controller. You can customise axes, swap them around, or change the response curve of any or all of them.

This may seem complex but, for the advanced user, the main Foxy editor will be an important feature. Korgy, a virtual keyboard, allows you to make simple assignments to any button, hat or wheel, and add modifications such as 'Hold' or 'Press and Release'.

Our Abit KG-7 and Athlon XP combination wasn't entirely happy with the control panel, however, and didn't always respond predictably to the changes we made. Cursor control on the desktop was lost a number of times, and in IL-2 it was sometimes necessary to apply choices more than once in order to gain HOTAS recognition.

The Cougar is currently the finest flight controller you can buy without pushing your spending into stratospheric levels; it isn't cheap, but its quality, feel and programmability are second to none. Get to know the Cougar, and you'll end up thinking of it as nothing less than a bargain.

Thrustmaster's finest carries a two-year warranty, and the firmware is flash-upgradeable. There's an excellent support site (designed and monitored by the developers themselves) at http://cougar.frugalsworld.com, which contains every imaginable resource for users and all the information potential buyers might want to study. Nordic users can get translations of the manual from Flight Sim Nordic, at www.fsnordic.net ■

Leonard Hjalmarson

Review Score

Manufacturer: Thrustmaster Inc.

Price: £249.99

Website: www.thrustmaster.co.uk

At a glance: Responsive, flexible, programmable, and beautifully constructed. Indistinguishable from the real thing, the Cougar is currently the ultimate HOTAS

System Requirements: USB port, DirectX 8

Downloads

Star performers from the Internet

Since the release of FS2002 the major flight simulator Internet sites have been swamped with aircraft, scenery and utilities, all designed to make it even more realistic than it already is. It is, however, becoming increasingly more difficult to find files that we can recommend for other simulations. So, if you've downloaded or designed a file you think is worth sharing, please drop us a line.

Fun-to-fly biplane elegance

PT-17 Stearman

Prop Aircraft

Flight Simulator 2002

Author: David Eckert
Sounds: Mike Hambly

The US Navy N2S-3 and the US Army Air Corps versions - two of the four variants in the package

The rather snazzy civilian variant, for those who like to be noticed

Superb modelling around that lovely radial engine

You can almost count the ribs on this baby

An uncluttered cockpit – just enjoy your flying!

This issue's Star Download is from David Eckert, a prolific and respected designer whose name regularly crops up in our Downloads section. The file contains four variants of the ageing PT-17 Stearman propeller biplane, complete with a custom commercial-style installation program.

David tells us that he built the model with Abacus's FS Design Studio 1.6b, while the textures were created in Corel Draw 9.0. He used another Abacus product, Aircraft Animator, to complete the animations, backed up by SDLEdit. Quite an assortment of utilities but, as a graphic designer, these are the tools of his trade. David's interest in aviation was originally sparked by his father, who spent 20 years in the USAF and was later a mechanic at United Airlines. As it happens, David himself is just a few hours away from his own PPL.

The PT-17 Stearman hails back to the 1940s, and at the time was one of the principal training aircraft used by the US military. It will probably be remembered more for its involvement in training those famous Tuskegee Fighters in South Carolina than for winning any design accolades, but the fact that many examples are still flying today is something of a testament to the ruggedness and durability of the design and construction.

The texture choices are: US Navy N2S-3, pre-WWII US Army Air Corp, PT-17 Boeing Stearman (silver), and a rather nice blue and white civilian scheme. All the models are beautifully crafted, with plenty of external detail for pilots who like to wander round their aircraft before take-off. As you might expect, however, the cockpit is somewhat spartan by today's standards, but contains nonetheless an authentic array of instruments that is perfectly sufficient for VFR flying. We particularly liked the virtual cockpit which, because of the open nature of the Stearman cockpit, provides a brilliant all-round view.

Typical of a biplane, the flight model is very forgiving and it's almost impossible to get out of shape. In fact you'll have to work quite hard to stall the Stearman, which is one of the reasons it was so popular as a training aircraft. It will fly along quite happily at 60 knots and stalls out at roughly 47-8 knots with a gentle pitch down but practically no wing drop. Finally, if you're used to a trike undercarriage then the tail dragger arrangement takes a bit of getting used to; this is particularly true on take-off and approach because you can't really see where you're going. Quite simply this is a beautiful aircraft which is genuinely fun to fly. ■

Joe Lavery

The rest of the best... all on the Cover CD

DHC6-300 Twin Sea Otter
Prop Aircraft

Flight Simulator 2002

Author: Barry Blaisdell
Panel: Dave Haskell

NDB Intercepts & Tracking
IFR Lesson

Flight Simulator 2002

Author: Fermin Fernandez

IA-58 Pucará Argentine AF
Prop Aircraft

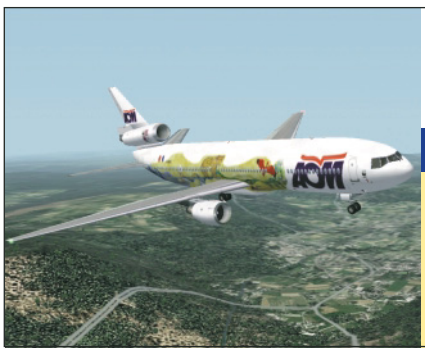
Flight Simulator 2002

Authors: Ariel Cimino and Cherar Suarez

Airports of Valdivia, Chile
Scenery

Flight Simulator 2002

Author: César Carrasco



DC-10 Series 30
Jet Aircraft

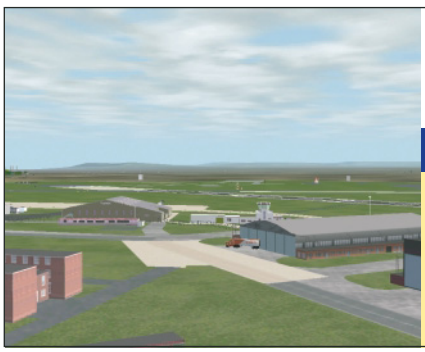
Flight Simulator 2002

Author: Freeware Flight Group
Paint: Pascal Linder

Falcon 50 F-CAEA
Jet Aircraft

Flight Simulator 2002

Author: Yannick Lavigne
Gauges: Fred Banting
Dynamics: Rob Young



Teesside Airport
Scenery

Flight Simulator 2002

Author: Don Alexander

Aeritalia G.222
Prop Aircraft

X-Plane

Author: Paolo Matricardi
Panel: Francesco Pacchioni

Embraer ERJ145 Colibrí
Jet Aircraft

Flight Simulator 2002

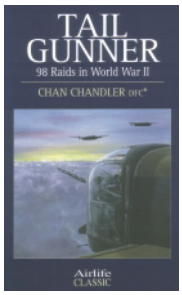
Author: José Antonio Moreno
Panel: Bill Grabowsky

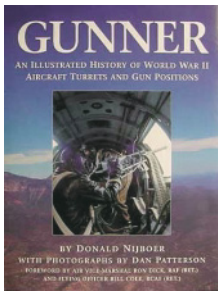
Lockheed C-141B Starlifter
Jet Aircraft

Flight Simulator 2000

Author: Jose Olliver
Panel: Flemming Hansen

Gunner & Tail Gunner




GUNNER
AN ILLUSTRATED HISTORY OF WORLD WAR II
AIRCRAFT TURRETS AND GUN POSITIONS
BY DONALD NIJBOER
WITH PHOTOGRAPHS BY DAN PATTERSON

Sticking to their guns

In his foreword to *Gunner*, Air Vice-Marshal Ron Dick quotes an RAF veteran: "The category of air gunner in the RAF lasted for less than fifty years. Post WWII, they are as outdated as the archers of Crécy." The pages that follow contain the complete history of air gunnery, from the moment in 1910 when a Lewis gun was attached to a Wright Flyer right up to the end of the war.

Historical analysis of the development of gunnery techniques and weaponry leads to more detailed studies of the gun stations in over 20 (mainly WWII) planes, grouped according to the number of engines they were equipped with. Superb and detailed photography puts you right in the gun turret, and an interesting assortment of archive photos is included, alongside RAF cutaway diagrams, posters, and gunnery manual illustrations.

The photography is striking, and never has the isolation and sheer flimsiness of the gunners' positions looked so uninviting; take, for example, the turret on the Blenheim or the exposed IL-2 gun position and the canvas strap that served as a seat; no wonder that IL-2 gunners were killed seven times more often than their pilots. Looking at the side blisters attached to the Catalina makes you relieved to read that these slow and steady planes rarely saw combat. *Gunner* is not only immaculately presented – it's also well researched and a joy to read. Frank recollections from veterans accompany the chapters devoted to each plane, and are an education in themselves; freezing cold, boredom and confinement are recurring themes.

Cramped conditions in the Liberator nose. Swivelling the turret let in icy blasts of air

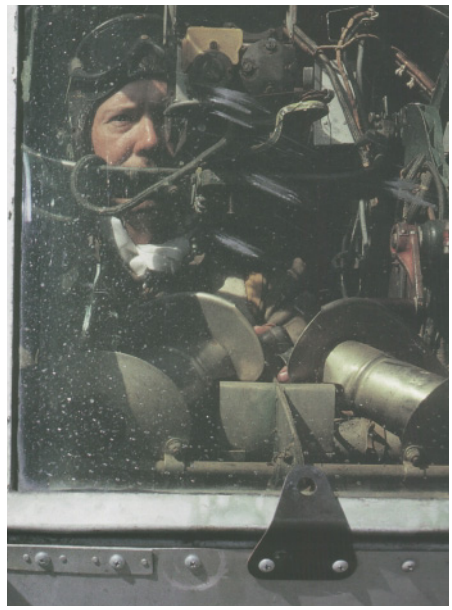
Chan Chandler's *Tail Gunner* serves to remind us of what actually went on in some of those turrets before they became museum pieces. Having joined the RAF at the start of WWII, he logged a total of 557 hours flying, most of them as an air gunner with 49 and 617 (Dambusters) Squadrons.

From his initial training in a Fairey Battle to Bomber Command missions in Lancasters and Manchesters, the discomfort, nervous exhaustion and vulnerability suffered by the gunner are ever present: "…it was possible to be so tired that you actually prayed to be shot down just so you could get some rest. Then when you got down you would often find that you could not sleep".

Chandler flew in the first 1,000-bomber raid, and also on the first occasion that more than 100 Lancasters bombed a single target, and the science of bombing was clearly one that fascinated him. The intensity of the bombing runs, however, is offset by plenty of comic moments – unusual methods for clearing birds off runways, coming under fire from the 'neutral' Swiss, 'goolie chits', and his first wartime injuries coming not from the enemy but from Guy Gibson's car.

After the war, he spent time with the Resistance in Scandinavia and the Phony Film Unit in Berlin, but most of his wartime experiences were in a gun turret; he adapted from the hand-operated weaponry of the Hampden to the four belt-fed Brownings in Lancasters, and fought to survive through some of the most devastating events of the war. Perhaps the most telling summary of his career can be found in his log of operational tours. The first entry contains a breezy, "Beautiful sunset". The final entry in June 1945 ends with, "Thank God, no more bloody aeroplanes for me". Finding out what happened in the intervening years to just one gunner who beat the odds makes *Tail Gunner* worthwhile reading. ■

Joe M. Besser



Liberator tail gunner behind 2.2 inch-thick glass

Martin B-26B side gun - a single gunner manned the guns on both sides of the aircraft

Tail Gunner Review Score

Publisher: Airlife Publishing Ltd

Price: £8.99

Website: www.airlifebooks.com

Authors: Chan Chandler DFC

At a glance: Life in the gun turret and under Leonard Cheshire VC, from a veteran of 106 sorties.

Gunner Review Score

Publisher: Airlife Publishing Ltd

Price: £24.99

Website: www.airlifebooks.com

Author: Donald Nijboer

At a glance: A worthy companion volume to the author's earlier *Cockpit*. Flawless photography by Dan Patterson.

Mosquito SQUADRON

FOR MICROSOFT® COMBAT FLIGHT SIMULATOR 2 & FLIGHT SIMULATOR 2000/2002

FLY THE 'WOODEN WONDER' MOSQUITO FB. MkVI - WITH 21 HISTORICALLY ACCURATE MISSIONS FOR COMBAT FLIGHT SIMULATOR 2

There are 21 historically accurate missions for CFS2 pilots, including the daring Operation JERICHO raid on Amiens prison, attacks on trains and on Gestapo HQ at Copenhagen. Full mission briefings are included in the detailed manual that's a work of art in itself!

Brilliantly rendered textures and surfaces

Accurately detailed virtual cockpit and faithfully reproduced instrument panels

The de Havilland D.H. 98 Mosquito, dubbed the 'Wooden Wonder' because of its all-wood construction, is probably one of the most famous RAF aircraft of World War II.

In this state-of-the-art expansion for Flight Simulator 2000/2002 and Combat Flight Simulator 2, you now have the opportunity to fly this high-performance machine in its FB.Mk VI guise. The aircraft comes complete with custom-designed instrument panels, gauges, flight models and sounds. Scenery of RAF Methwold and the village of Methwold itself is also included and Combat Flight Simulator 2 pilots can take part in 21 historically accurate missions that commemorate the success of what was arguably one of the first true multi-role aircraft.

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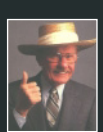
- Fly 25 aircraft over 5 different regions around the world.
- Race against AI aircraft or multiplayer over Internet or LAN with up to 8 pilots.
- 3 levels of difficulty with authentic and realistic aircraft dynamics, including prop wash.
- Even includes an exclusive combat "eye on target" training mode, as used in training by the US Air Force for cadet pilots!



Fully endorsed by the National Championships and aviation legend Bob Hoover himself, this sim has received near-enough universal praise from PC gamers and simulation press alike.

Computer Games Editor's Choice

★★★★½ "Will appeal to flight and racing fans alike"

PC GAMER "Impressive... makes the Indy 500 look like a wussy convention"

PC PILOT "This is as exciting as flying gets!"

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